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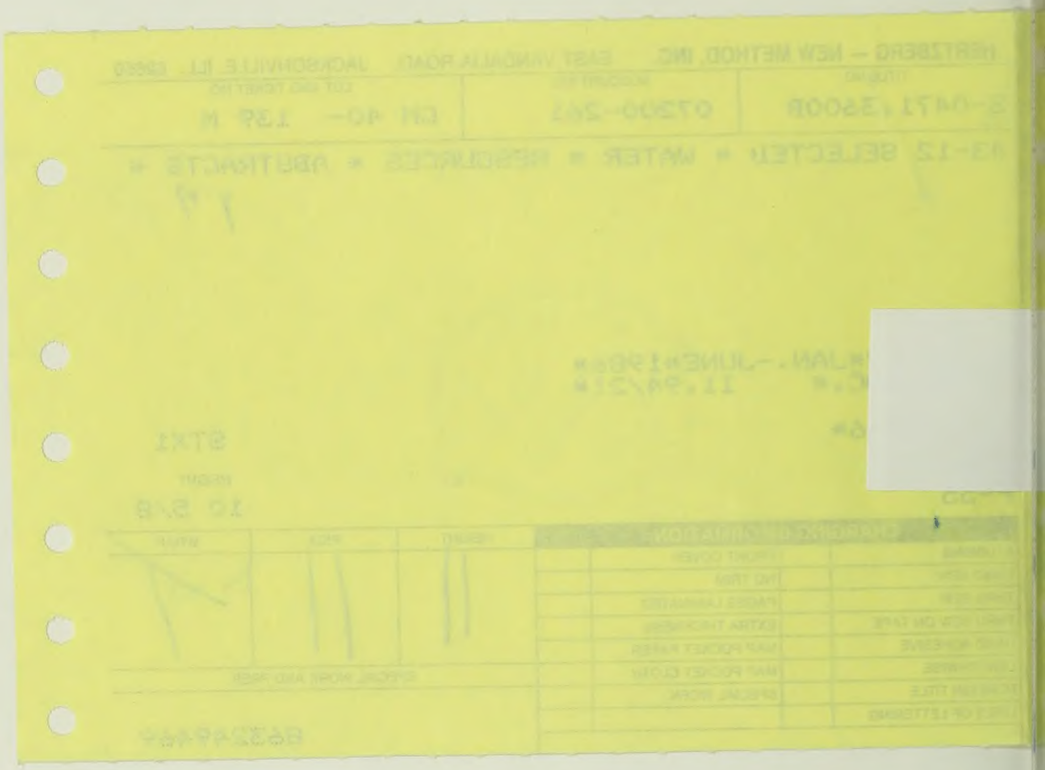

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 19, NUMBER 1
JANUARY 1986

W86-00001 -- W86-00307

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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08 ENGINEERING WORKS

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

SPATIALLY VARYING RAINFALL AND FLOODRISK ANALYSIS,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 2E.
W86-00012

NONLINEAR TIME-VARIANT CONSTRAINED MODEL FOR RAINFALL-RUNOFF,
Arkansas Univ., Fayetteville. Engineering Experiment Station.
B. Datta, and D. P. Lettenmaier.
Journal of Hydrology, Vol. 77, p 1-18, 1985. 3 Fig, 7 Tab, 11 Ref. State of Washington Water Research Center project C-00234.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Constrained linear system model, *Nonlinear models, Hydrologic models, Precipitation, Runoff, Mathematical studies, Statistical analysis, Hydrologic models.

Models of the rainfall-runoff process can be segregated into two classes: those based on input-output (black box) techniques, and those based, directly or indirectly, on the laws of physics. Both approaches have limitations and advantages. A combined model was developed which incorporates an approximated description of the physical process to estimate effective precipitation and uses the input-output estimation procedure of the constrained linear system (CLS) model to relate effective precipitation to runoff. Certain problems of poor calibration and prediction encountered with the CLS model were significantly reduced by using estimated effective precipitation in place of actual precipitation. Use of the precipitation preprocessor with the CLS runoff model effectively incorporates nonlinear and time-variant dynamics without the necessity for multiple-parameter vectors and antecedent precipitation thresholds required by the original version of CLS. Additional refinements, including time variability of some of the parameters, can easily be accommodated in the new formulation. (Author's abstract)
W86-00022

VARIOGRAM IDENTIFICATION BY THE MEAN-SQUARED INTERPOLATION ERROR METHOD WITH APPLICATION TO HYDROLOGIC FIELDS,
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique de Grenoble.
T. Lebel, and G. Bastin.
Journal of Hydrology, Vol. 77, p 31-56, 1985. 10 Fig, 10 Tab, 23 Ref.

Descriptors: *Variograms, *Mean squared interpolation error method, *Interpolations, *Hydrologic models, Model studies, Hydrologic data, Interpolation errror, Statistical analysis.

Real-life applications of BLU (best linear unbiased) interpolation in random fields, require, in most cases, a preliminary identification of a parametric model for the variogram of the field of interest. The variogram identification can be performed by minimizing a functional of a set of observed interpolation errors; the 'mean squared interpolation error' (MSIE) method is such a method for variogram identification. A theoretical analysis of the MSIE method was performed under the realistic assumption that the parametric variogram model is only an approximation of the true-field variogram. A general asymptotic property was demonstrated which does not require any specific assumption on the probability density of the field. In a piezometric field application, the variogram model was a basic tool for the contour mapping of the water level. The MSIE criterion is an efficient tool to discriminate between alternative variogram models and, in this case with scarce data, the models obtained with the MSIE method can differ substantially from those derived from the experimental variogram: a theoretical analysis of the robustness of the various identification methods with small data sets would be very useful. In a rainfall field application, the variogram model was needed to calculate mean areal rainfall variances and mean areal GRADEX. A global climatological variogram was identified: a very large data set was available and the best model was very close to the experimental variogram. An interesting cross-validation result is that the parameter estimates obtained from two subsamples of the complete data set are very close. (Collier-IVI)
W86-00024

REGIONAL FREQUENCY ANALYSIS OF MULTIYEAR DROUGHTS USING WATERSHED AND CLIMATIC INFORMATION,
Montgomery (James M.), Inc., Salt Lake City, UT.
E. G. Paulson, Jr., J. Sadeghipour, and J. A. Dracup.
Journal of Hydrology, Vol. 77, p 57-76, 1985. 1 Fig, 4 Tab, 31 Ref. NSF grant 77-11137 and University of California Water Resources Center grant W-615.

Descriptors: *Frequency analysis, *Droughts, *Climatology, *Statistical analysis, *Central Valley, *California, Meteorological data, Multiple regression analysis, Regression analysis, Streamflow, Data interpretation.

A regional frequency analysis of hydrologic multiyear droughts was performed using multiple linear regression to estimate characteristics of drought severity, magnitude and duration from indices of watershed geomorphology, and climate. Thirteen characteristics of drought severity, magnitude and duration were used as dependent variables; eleven indices of watershed geomorphology and meteorology were used as independent variables. Reasonable estimation accuracy was obtained utilizing Central Valley of California, U.S.A., streamflow data (mean standard errors between 14% and 41%). The proposed regression relations are primarily statistical models, and are not necessarily reliable indicators of cause-and-effect physical relationships. (Author's abstract)
W86-00025

STATISTICAL CHOICE OF EXTREMAL MODELS FOR COMPLETE AND CENSORED DATA,
Agricultural Univ., Wageningen (Netherlands). Dept. of Mathematics.
M. A. J. Van Montfort, and M. I. Gomes.
Journal of Hydrology, Vol. 77, p 77-87, 1985. 3 Fig, 2 Tab, 10 Ref, 1 Append.

Descriptors: *Statistical analysis, *Mathematical studies, *Extremal models, *Censored data, Data interpretation, Hydrologic data, Model studies, Probability distribution.

Often one of the three well-known limiting distributions of univariate extremes, e.g. maxima of riverflow or precipitation, is successfully fitted to the data, and the estimated values corresponding to given return periods calculated. Within the framework of the general extreme-value distribution (GEV, with shape parameter Theta), which combines the Frechet (Theta $<$ 0), Gumben (Theta = 0) and Weibull types (Theta $>$ 0), the power functions of some statistics for rejecting the Gumbel distribution (Theta = 0) were compared. Often in checking the suitability of a distribution, a goodness of fit test is used involving the whole range of the distribution while the valid interest is in one tail only. The interest in whether Theta deviates from zero arises when one is concerned with the value of a variate corresponding to a return period nearly equal to the length of the sample. The conditions for adequate behavior in the right-hand tail are not always the same as for the left-hand tail, and lack of fit in the left-hand tail should not influence inferences concerning the right-hand tail. It is necessary to consider the loss in power of tests for rejecting Theta = 0 in left-hand censored samples, where the observations with a rank lower than a specified value are missing. (Collier-IVI)
W86-00026

DISCRETE-TIME LINEAR CASCADE UNDER TIME AVERAGING,
National Hydrology Research Inst., Ottawa (Ontario).
V. Klemes, I. Klemes, and J. E. Glynn.
Journal of Hydrology, Vol. 77, p 107-123, 1985. 5 Fig, 13 Ref, 1 Append.

Descriptors: *Streamflow, *Model studies, *Linear cascades, *River basins, Stochastic process, Basin storage, Hydrologic models.

A cascade of linear reservoirs defined in discrete time has been suggested as a lumped conceptual model for a river basin for the case when the streamflow (basin output) at a control point is represented by an autoregressive time series in which the (uncorrelated and identically distributed) random component represents the time series of net basin input, i.e. roughly speaking, of precipitation minus evapotranspiration. An attempt has been made to find out whether the relationship between the total gravity storage of a basin and its runoff, whose empirical determination is within the reach of hydrologic analysis, can be used to test the assumption of linearity of a discrete-time stochastic hydrologic model. A theoretical investigation of the relationship between the total storage in a discrete-time linear cascade and the output at time t, and between averages of these two variables over T consecutive times, is examined. (Baker-IVI)
W86-00028

COMPARISON OF TWO DAILY STREAMFLOW SIMULATION MODELS OF AN ALPINE WATERSHED,
Colorado Univ. at Boulder. Dept. of Civil, Environmental, and Architectural Engineering.
For primary bibliographic entry see Field 2E.
W86-00033

DETERMINATION OF RESISTANCE PARAMETERS OF PLUVIO-NIVO-GLACIAL ALPINE SYSTEMS BY MATHEMATICAL MODELING OF RUNOFF,
Vrije Univ., Amsterdam (Netherlands). Dept. of Hydrogeology and Geographical Hydrology.
For primary bibliographic entry see Field 2E.
W86-00034

MULTIPLE NONLINEAR STATISTICAL MODELS FOR RUNOFF SIMULATION AND PREDICTION,
Alcoa of Australia Ltd., Applecross.
For primary bibliographic entry see Field 2E.
W86-00035

EFFECTS OF INCORRECTLY REMOVED PERIODICITY IN PARAMETERS ON STOCHASTIC DEPENDENCE,
George Washington Univ., Washington, DC. International Water Resources Inst.
V. Yevjevich, and J. T. B. Obeysekera.
Water Resources Research, Vol. 21, No. 5, p 685-690, May, 1985. 6 Fig, 2 Tab, 7 Ref. NSF grant CEE-7916817 and CEE 84-05289/85-41631.

Descriptors: *Hydrologic time series, *Stochastic hydrology, *Time series analysis, Mathematical studies, Seasonal variation, Model studies, Harmonics.

Most hydrologic time series are periodic-stochastic processes in which the stochastic component is mixed with periodic parameters. Modeling of seasonal hydrologic time series often requires the identification of periodic functions of its basic parameters such as the mean, standard deviation, and autocorrelation coefficients. The consequences of incorrect estimation of harmonics on dependence models of the stochastic component are investigated. For each underestimated harmonic in the periodic mean the stochastic nonstationary dependence models will have four additional terms, with four coefficients to be estimated instead of only two in the harmonic. For each overestimated harmonic in the mean two additional coefficients must be esti-

mated, with a slight effect on estimated coefficients of dependence models and a practically negligible effect on model identification. If one has to select between underestimation or overestimation, the penalty is smaller for the case of overestimation of harmonics in the mean. The identification of the dependence model of the stochastic component is not significantly affected either by underestimation or overestimation. A neglect of periodicity in autocorrelation coefficients leads to inferences of incorrect stationary stochastic dependence models, while in reality they are nonstationary. (Baker-IVI)
W86-00075

SYNTHESIS OF RADAR RAINFALL DATA,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
W. F. Krajewski, and K. P. Georgakakos.
Water Resources Research, Vol. 21, No. 5, p 764-768, May 1985. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Rainfall, *Radar, Rainfall-runoff relationships, Model studies, Hydrologic models, Simulation, Rain gages, Mathematical studies.

Procedures are being developed to merge radar and rain gage observations, to obtain the best estimate of the rainfall field, taking advantage of the spatial detail that the radar gives and of the high point accuracy of the gages. Reliable synthesis of radar-rainfall fields can be useful for validation as an alternative to field experiments. A method of generating synthetic radar-rainfall data is described. The data are generated by imposing random noise on a given, high-quality radar-rainfall field. Certain conditions are imposed on the resultant rainfall field so that the noise parameters are prespecified. In that way nonstationary nonergodic fields can be simulated. Since the original and the observation (original and noise) fields are known, the method can be used in the validation procedures of various hydrologic models (radar and rain gage data merging, mean areal precipitation estimation, rainfall-runoff). The example given shows that the accuracy of the preservation of the required statistics is very good, especially for realistic values of the variance measure, even for a relatively small number of realizations. The method proposed is flexible in that one can generate fields with a wide range of second order statistics from one high quality radar field. When the technique is used to investigate radar and rain gage data merging, a procedure is required to synthesize the gage data. (Baker-IVI)
W86-00084

ATTEMPT TO IMPLEMENT SWMM IN TUNISIA,
Lund Univ. (Sweden).
For primary bibliographic entry see Field 6A.
W86-00087

DATA MANAGEMENT FOR CONTINUOUS HYDROLOGIC SIMULATION,
North Carolina Univ. at Charlotte. Dept. of Urban and Environmental Engineering.
J. S. Wu.
In: Proceedings of Stormwater and Water Quality and Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 161-176, 11 Fig, 6 Tab, 4 Ref.

Descriptors: *Rainfall-runoff relationships, *Rainfall, *Runoff, *Agricultural watersheds, *Hydrologic models, *Model studies, *Regression analysis, *Watershed management, *Agricultural runoff, Evapotranspiration, Models, Watersheds, Groundwater recharge, Soil water, Simulation analysis.

The U.S. EPA's Agricultural Runoff Model (ARM) was applied to the continuous hydrologic simulation of one of the agricultural watersheds of the Chowan River Basin in North Carolina. Regression analysis was employed to generate missing rainfall-runoff data required for calibration of the ARM model. Monthly rainfall, evapotranspiration and runoff data served as model input data and output data consisted of monthly rainfall, runoff, evapotranspiration, soil moisture changes, and groundwater recharge. Model simulations agreed well with per storm comparisons and recorded hydrographs and demonstrated the successful calibration for the Cutawhiskie site of the watershed. With a good data-base for calibration and verification, the continuous hydrological simulation model can be a useful tool for evaluating the effectiveness of watershed management practices over an extended period of time.
W86-00093

SNOWMELT INDUCED URBAN RUNOFF IN NORTHERN SWEDEN,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 2C.
W86-00097

STORM SEWER OPTIMUM DESIGN,
For primary bibliographic entry see Field 8B.
W86-00100

ATCHAFALAYA RIVER DELTA; REPORT 8: NUMERICAL MODELING OF HURRICANE-INDUCED STORM SURGE,
Coastal Engineering Research Center, Vicksburg, MS.
B. A. Ebersole.
Technical Report HL-82-15, January 1985. Report 8 of a Series. 94 p, 61 Fig, 6 Tab, 21 Ref.

Descriptors: *Mathemetical models, *Simulation analysis, *Hydrodynamics, *Hurricanes, *Tidal hydraulics, Models, Model studies, Numerical analysis, Mathematical studies, Bays, Tides, Storm surges, Storm tides, Hydraulic models.

The U.S. Army Engineer Waterways Experiment Station Implicit Flooding Model (WIFM) was applied to the Atchafalaya River Delta Project. This numerical model was used to simulate the hydrodynamics within the bay resulting from astronomical and/or meteorological forcing. The WIFM model solves finite difference approximations of the governing equations on a grid mesh of fixed spatial extent for a finite number of constant time increments, utilizing an alternating-direction, implicit solution scheme. The accuracy of the model was verified using a comparison of observed and simulated water elevations. Comparisons showed that the model can accurately simulate the response of the system to the astronomical tide and hurricanes. In the case of tides alone, errors were very small. However, in the storm surge applications, errors were larger. Using the verified model, a set of hypothetical storms was simulated. Dynamical characteristics of these storms reflect hurricanes that have occurred in this area in the past. Hydrodynamics from these storms will be used in other tasks to investigate the response of the Atchafalaya River delta growth to extreme meteorological events.
W86-00164

HYDROLOGICAL YEARBOOK: 1980.
Reeve (Douglas) and Associates, Toronto (Ontario).
Publications of the Water Research Institute, No. 53, 1983. 174 p, 2 Maps, 7 Append.

Descriptors: *Watersheds, *Hydrologic data collections, *Precipitation, *Runoff, *Floods, Finland, Groundwater, Rivers, Water level, Ice, Snow cover, Water temperature, Temperature, Hydrographs, Lakes, Frost, Water storage.

Hydrological statistics for Finland are reported. At the beginning of 1980 water storage was average for the season. Toward the end of the year storage was exceptionally low in the north and plentiful in the south. A 100-yr flood for autumn occured in the Aurajoki in late November; other rivers flooded during this time. At the end of the year record snow cover, up to 150 mm of water in some places, was on the ground. Tables and hydrographs include data on water levels and stages, discharge, maps of hydrological basins, runoff, areal precipitation and water equivalent of snow cover, evaporation, surface temperature of open waters, dates of freeze-up and ice breakup, ice cover thickness, ground frost, and groundwater.
W86-00182

HYDROLOGICAL SIMULATION PROGRAM--FORTRAN (HSPF): USERS MANUAL FOR RELEASE 8.0,
University of the Pacific, Stockton, CA.
R. C. Johanson, J. C. Imhoff, J. L. Kittle, and A. S. Donigan.
EPA-600/3-84-006, June 1984. Environmental Protection Agency, Athens, GA. 767 p, 138 p, 49 Ref, 5 Append. Contract/Grant No. 68-01-6207.

Descriptors: *Hydrologic models, *Model studies, *Computer programs, Streams, Lakes, Hydrological Simulation Program--FORTRAN, Water quality, Water supply, Rainfall-runoff relationships, Data processing, Fortran.

The Hydrological Simulation Program--FORTRAN (HSPF) is a set of computer codes that can simulate the hydrologic, and associated water quality, processes on pervious and impervious land surfaces and in streams and well mixed impoundments. The manual discusses the modular structure of the system, the principles of structured programming technology and the use of these principles in the construction of the HSPF software. In addition to a pictorial representation of how each of the 500 subprograms fits into the system, the manual presents a detailed discussion of the algorithms used to simulate various water quality and quantity processes. Data useful to those who need to install, maintain, or alter the system or who wish to examine its structure in greater detail also are presented. (Author)
W86-00199

2B. Precipitation

STATISTICAL ANALYSIS OF PRECIPITATION FREQUENCY IN THE CONTERMINOUS UNITED STATES, INCLUDING COMPARISONS WITH PRECIPITATION TOTALS,
Midwest Research Inst., Kansas City, MO.
P. J. Englehart, and A. V. Douglas.
Journal of Climate and Applied Meteorology, Vol. 24, No. 4, p 350-362, April, 1985. 7 Fig, 5 Tab, 32 Ref. NSF grant ATM-8219370.

Descriptors: *Statistical analysis, *Total precipitation, *Precipitation frequency, *Weather data collections, Data interpretation, Spatial distribution, Temporal distribution.

An alternative measure of time-aggregated precipitation for use in short-term climate studies was developed; this measure, precipitation frequency, is defined as the number of days per month or season with total amounts $>$ or $=$ 2.54 mm (0.10 inch). Newly created data sets for the period 1951-80 were used as a basis for describing large-scale spatial and temporal features of precipitation frequency for the mainland United States. Comparisons between precipitation frequency and the conventional statistic, total precipitation, indicate that frequency is more normally distributed and more spatially coherent than total precipitation. Factor analysis and an orthogonal rotation to the varimax criterion identify synoptic-scale, spatially coherent regions of precipitation frequency. The regions are generally consistent with previously documented cyclone trajectories. (Author's abstract)
W86-00020

SOIL MOISTURE CONTENT: STATISTICAL ESTIMATION OF ITS PROBABILITY DISTRIBUTION,
Kozponti Meteorologiai Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 2G.
W86-00021

ANALYSIS OF THE EFFECTS OF OROGRAPHY ON SURFACE RAINFALL BY A PARAMETERIZED NUMERICAL MODEL,
Consiglio Nazionale delle Ricerche, Perugia (Italy). Ist. di Ricerca per la Protezione Idrogeologica nell' Italia Centrale.

C. Corradini.
Journal of Hydrology, Vol. 77, p 19-30, 1985. 3 Fig, 1 Tab, 12 Ref.

Descriptors: *Orography, *Rainfall, *Model studies, *Geography, *Upper Tiber River basin, *Italy, Spatial distribution, Hydrologic models, Data interpretation, Orographic precipitation, Precipitation.

A numerical model was formulated for estimating the spatial distribution of rainfall on the meso-local scale; the model considers widespread rainfall not influenced by convective processes. The observed rainfall on the soil surface unaffected by orographically produced contributions and meteorological parameters on the large scale are used as inputs to the model. The model is then used for computing the spatial distribution of rainfall incorporating the orographic effects in a parameterized form. The model was applied to four rainfall events over an area of the Upper Tiber River basin (central Italy); the results compare reasonably well with the observations in each event. The error in computing mean areal rainfall ranges in magnitude from 1% to 15%; for each event at least 75% of the point-estimates has an error of less than + or - 30%. (Author's abstract)
W86-00023

INTERCEPTION STORAGE CAPACITIES OF TROPICAL RAINFOREST CANOPY TREES,
Boston Coll., Chestnut Hill, MA. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2I.
W86-00037

ESTIMATION OF MISSING VALUES IN MONTHLY RAINFALL SERIES,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
E. Foufoula-Georgiou.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 177-191, 3 Fig, 6 Tab, 19 Ref.

Descriptors: *Statistical analysis, *Time series analysis, *Statistical models, *Model studies, *Mathematical studies, *Stochastic process, *Stochastic hydrology, *Model testing, Statistical methods, Theoretical analysis, Models, Mathematical models.

Three methods for infilling missing values in hydrological time series are discussed. The first method utilizes regional-statistical data by the mean value method, the reciprocal distance method, the normal ratio method or the modified weighted average method. The second method uses a univariate stochastic (ARMA) model which describes the time correlation of the series. The third technique relies on a multivariate stochastic (ARMA) model which describes the time and space correlation of the series. An algorithm for the recursive estimation of the missing values by a parallel updating of the univariate or multivariate stochastic ARMA models is proposed and demonstrated. All of the infilling methods were applied to a case study using 55 yr of monthly rainfall data from four south Florida stations. Results showed that all the the traditional estimation techniques give unbiased (overall and monthly) means and correlation coefficients at the 5% significance level for as high as 20% missing values. If an ARMA model is to be used in an incomplete series to construct forecasts, then the estimation of missing values and parameters of the model by the proposed recursive algorithm is recommended.
W86-00094

AREAL INTENSITY-DURATION-FREQUENCY CURVES: A POSSIBLE WAY OF IMPROVING THE RAINFALL INPUT,
Lund Univ. (Sweden). Dept. of Water Resources Engineering.
J. Niemczynowicz.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 192-201, 6 Fig, 1 Tab, 17 Ref.

Descriptors: *Areal precipitation, *Rainfall intensity, *Graphical methods, *Precipitation intensity, *Depth-area-duration analysis, *Frequency analysis, *Regional analysis, *Mathematical studies, Precipitation, Storms, Rainfall, Runoff, Rain gauges, Urban hydrology, Data interpretation.

Point and areal intensity-duration-frequency (i-d-f) curves for the city of Lund, Sweden were generated using data from a 25 sq km area raingauge network with 12 gauges installed in 1978. The gauges were of the automatic tipping-bucket type and were governed by the same clock to achieve absolute time synchronization. Since the main goal of this study was to compare the point rainfall statistics with the areal rainfall statistics for short term rainfalls, all events with low intensity were taken out of the data base. To extrapolate rainfall data from point to areal values, specific areas were associated to all gauges. Analysis of results showed that areal i-d-f relationships gave different rainfall values then point i-d-f relationships. Areal rainfall intensity values were lower for all durations and return periods. If point i-d-f curves are used for deriving design storms, the error in average rainfall intensity and rainfall volume will be introduced for simulation of runoff from real catchments. The magnitude of error depends on duration, return period, and catchment size. The most significant differences between point and areal rainfall values can be found for short durations and long return periods. The areal i-d-f curves gave more realistic design storms than those derived from point i-d-f curves.
W86-00095

OUTLINE OF SEVERE LOCAL STORMS WITH THE MORPHOLOGY OF ASSOCIATED RADAR ECHOES,
National Weather Service Training Center, Kansas City, MO.
R. Grebe.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-114454. National Oceanic and Atmospheric Administration, Rockville, MD. June 1982. NOAA Technical Memorandum NWS TC 1. 80 p. 56 Fig, 64 Ref, 9 Append.

Descriptors: *Radar, *Storms, *Thunderstorms, *Weather forecasting, *Storm warnings, Storms, Velocity derived fields, Doppler radar.

This outline focuses on the interpretation of conventional radar data for the identification of severe local storms. The technique of improving warnings is dependent upon the ability to identify the potential before the event occurs. The primary tools presently available include trained spotters, and satellite and radar observations. Most of the radar research work in severe local storms accomplished in the 1970's was done with Doppler radar. Doppler is conventional radar plus 'more'. The 'more', velocity derived fields, has increased our understanding of storm structure and the morphology of precipitation related echoes. It will be to the advantage of the operational community using conventional radar to apply the technology of Doppler in a practical way. Documented radar signatures associated with severe local storms dating back to the 1950's have been included. Some of them are in apparent conflict with contemporary storm models. The rationale for including them is (1) these signatures can still be operationally useful as alerting features and (2) today's storm models are likely to change as our understanding of the physical processes that produces them increases. As such, this outline is not intended to conflict with National or Regional Weather Service policy regarding the use of radar signatures in issuing severe thunderstorm or tornado warnings. The test of a radar signature leading to the identification of a severe local storm occurs in the field under the stress of making day-to-day warning decisions. No signature or combination of signatures guarantees the existence of a severe storm any more than a numerical model will produce a perfect weather forecast. In both cases, a probability is assigned to the occurrence of the event and a decision is based on that probability.
W86-00146

MARINE WEATHER OF THE INLAND WATERS OF WESTERN WASHINGTON,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. E. Overland, and B. A. Walter.
NOAA Technical Memorandum ERL PMEL-44, January 1983. 62 p, 30 Fig, 7 Tab, 42 Ref.

Descriptors: *Precipitation, *Meteorology, *Climatic data, *Marine climates, *Weather patterns, Washington, Puget Sound, Pacific Ocean, Wind, Olympic Mountains, Topography, Temperature, Hydrology, Hood Canal bridge.

The mid-latitude, west coast marine climate of western Washington is typified in summer by high sea-level pressure as part of the North Pacific weather pattern and in winter by a sequence of storms which originate to the west. Mean and extreme temperatures are moderated by the proximity of the Pacific Ocean and Puget Sound, resulting in a mean temperature of 4 degrees C in January and 17 degrees C in August at Seattle. Local variations in precipitation and wind are influenced by both large-scale weather patterns and the region's topography. Fifty percent of the annual precipitation for most of the inland region falls in the four months from November through February, and less than five percent falls in July and August; the driest region is to the northeast of the Olympic Mountains. Over the inland waters, the winds flow from high to low sea-level pressure in the direction of the local channels. Recent studies by the University of Washington and the Pacific Marine Environmental Laboratory on the Puget Sound convergence zone, sea and valley breeze, precipitation patterns and local wind patterns are summarized. The storm which resulted in destruction of the Hood Canal Bridge has shown that the presence of the Olympic Mountains can induce a regional low-pressure system in their lee which can result in strong surface winds over the inland waters. (Author)
W86-00165

SCPP DATA COLLECTION AND ANALYSIS FOR THE PERIOD 1 SEPTEMBER 1981 THROUGH 31 AUGUST 1982,
Atmospherics, Inc., Fresno, CA..
M. Solak, T. Henderson, R. Allen, S. Barnes, and M. Henderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-116707. Interim Progress Report Number Four, August 27, 1982. 182 p, 62 Fig, 13 Tab, Append. Contract/Grant No. 9-07-85-V0020.

Descriptors: *Precipitation, *Network design, *Cloud physics, *Ice formation, *Weather modification, Sierra Nevada, Orographic precipitation, Data collections, Supercooling, Cooling, Data acquisition, Meteorological data collection, Data processing, Gages, Snow.

Data collection and analysis tasks performed for the Sierra Cooperative Pilot Project are described. The Sierra project is concerned with the physical processes of precipitation formation during the winter over a portion of the Sierra Range in California, artificial enhancement of winter precipitation, and weather resources management to improve California's water resources in this mountain range. Tasks performed were installation, operation, and maintenance of, and data collection and analysis from, a network of precipitation gages as well as ground-based instrumentation for detection of supercooled liquid water.
W86-00216

GROUND-BASE SNOW AND ICE CRYSTAL OBSERVATION SYSTEM USED IN SIERRA NEVADA WINTER OROGRAPHIC STORMS,
Atmospherics, Inc., Fresno, CA..
M. Henderson, M. Henderson, S. Pinion, E. Pinion, and M. Solak.
Technical Report AISCP-841, April 1984. 34 p, 3

Fig, 5 Tab, 38 Photos, 9 Ref. Contract/Grant No. 0-07-85-V0020.

Descriptors: *Precipitation, *Weather modification, *Snow, *Ice, Orographic precipitation, Photography, Cloud physics, Cloud seeding, Artificial precipitation, Sierra Nevada, California, Sierra Cooperative Pilot Project, Sampling, Data acquisition, Crystals.

This report describes the use of a ground based photographic snow and ice crystal observation system during two winter seasons at a fixed sampling site near the summit of the central Sierra Nevada range of California. This research effort was performed as part of the Bureau of Reclamation's Sierra Cooperative Pilot Project (SCCP), an investigation of the technical feasibility and potential economic benefit of cloud seeding in the Sierra Nevada to supplement the region's water supply. Two specific photographic systems and their operational use are detailed. Data reduction and analysis techniques are also described. Conclusions are presented relating to three key topic areas. Those are (1) the suitability of the sampling equipment, sampling strategies and data acquisition/reduction techniques used in the SCPP application, (2) clues to seedability in Sierra storms and (3) the utility of ground-based microphysics measurements in evaluating seeding experiments. (Author)
W86-00222

APPLICATION OF PROBABLE MAXIMUM PRECIPITATION ESTIMATES: UNITED STATES EAST OF THE 105TH MERIDIAN,
National Weather Service, Silver Spring, MD. Office of Hydrology.
E. M. Hansen, L. C. Schreiner, and J. F. Miller.
Available from the Technical Information Service, Springfield, VA 22161 as PB83-118166. NOAA Hydrometeorological Report No. 52, August 1982. 168 p, 57 Fig, 31 Tab, 22 Ref, 1 Append.

Descriptors: *Precipitation, *Rainfall, Rainstorms, Maximum probable precipitation, Meteorology, Storms, Isohyets, Temporal distribution, Spatial distribution, Distribution, Estimating.

A stepwise approach to adapting the temporal and spatial distribution of probable maximum precipitation estimates to a specific drainage is given. An elliptical isohyetal pattern with a ratio of major to minor axes of 2.5 to 1 is recommended. Procedures are outlined for obtaining appropriate isohyet values and for determining probable maximum precipitation values for durations less than 6 hours. The shape and orientation of isohyetal patterns for major rainfalls of record are included. An appendix lists storm duration, storm area, and 24-hour rainfall for 253 major storms from 1878 to 1972.
W86-00229

BOULDER UPSLOPE CLOUD OBSERVATION EXPERIMENT.
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-116673. June 1982. Earl E. Gossard, editor. 237 p, 34 Fig, 14 Tab, 2 Ref, 2 Append.

Descriptors: *Precipitation, *Cloud physics, *Remote sensing, *Meteorologic data collection, Upslope precipitation, Ice, Snow, Fog, Radar, Radiometers, Lidar, Aircraft, Ceilometer, Boulder Upslope Cloud Observation Experiment, Data collections, Crystals, Microwaves, Weather.

The Boulder Upslope Cloud Observation Experiment was designed to learn more about the role of ice crystals in the formation of clouds and precipitation under upslope conditions; to calibrate the remote sensing systems against reliable in situ devices in a steady, homogeneous cloud environment; and to evaluate the systems' applicability for observing the role of ice crystals and cloud microphysics in the evolution of upslope precipitation. Eleven principal weather events in the spring of 1982 are described. In situ measurements were made by aircraft, tower particle measurements, surface chemistry sampling, all-sky camera, and rotating beam ceilometer. Ground-based remote sensing measurements were made by radiometer, radar, and lidar.
W86-00261

POSTSTORM RECONNAISSANCE OF TROPICAL STORM CHRIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
T. H. Flor.
Miscellaneous Paper HL-83-5, July 1983. Final Report. 18 p, 9 Fig, 6 Append.

Descriptors: *Precipitation, *Storms, Tropical Storm Chris, *Flood damage, Tidal floods, Shores, Seashores, Damage, Rainstorms.

Tropical Storm Chris made landfall in Louisiana, 7 miles east of Sabine Pass, Texas, at 0600 CDT on September 11, 1982. Highest sustained winds were 55 knots. Lowest pressure was estimated to be 994 mbs. Highest tides were between 5 and 6 feet just east of the center. Rainfall was 5 to 10 inches in Louisiana, with a few local amounts greater than 10 inches. The highest storm-generated surge, 8.5-9 ft, occurred at Peveto Beach, 8 miles east of the point of landfall. Flooding west and east of the point of landfall was 2.8 ft above predicted tide level 17 miles to the west and 2.5 ft above predicted tide 19 miles to the east. No casualties were reported. Damage estimates were $< \$1$ million in Louisiana. Power lines, trees, and boats were also damaged, as well as a restaurant in Texas.
W86-00279

CLOUD PHYSICS STUDIES IN THE SCPP: INTERIM PROGRESS REPORT, 1983-84.
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W86-00305

STRUCTURE OF COLD FRONTS OVER CALIFORNIA,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W86-00306

RESPONSES TO SEEDING CLOUDS WITH DRY ICE IN THE SCPP-1 EXPERIMENT,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W86-00307

2C. Snow, Ice, and Frost

RUNOFF FROM GLACIERIZED MOUNTAINS: A MODEL FOR ANNUAL VARIATION AND ITS FORECASTING,
Stirling Univ. (Scotland). Dept. of Environmental Science.
For primary bibliographic entry see Field 2E.
W86-00077

SNOWMELT INDUCED URBAN RUNOFF IN NORTHERN SWEDEN,
McMaster Univ., Hamilton (Ontario).
L. Bengtsson.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 215-236, 6 Fig, 11 Tab, 10 Ref.

Descriptors: *Snowmelt, *Runoff, *Snowpack, *Design criteria, *Melting, *Urban runoff, *Surface runoff, *Overland flow, Annual runoff, Soil water, Infiltration rate, Infiltration capacity, Snow cover, Thaw, Urban hydrology.

Snowmelt and runoff data collected at different sites in the Lule region of Sweden over a 7 yr period are summarized and analyzed. The maximum observed melt flux to the base of a snowpack during 1 h is 4.1 mm/h. The maximum observed daily melt is 40 mm, but the daily melt of a 2-yr return period is only 20 mm. The runoff from small study plots, at least in practical considerations, is found to be distributed over about 12 h. The maximum observed runoff from these study plots of hard packed gravel or grass surfaces is about 2 mm/h. In the late phase of a snowmelt period, the daily runoff closely corresponds to the daily melt. However, the very maximum runoff values are observed during or some days after the snowmelt period. Overland flow or flow just below the ground surface takes place. Design melt rates for open areas in Sweden are 20 mm/12 h for a melt rate of 1-yr return period and 3 mm/h for a shorter interval. For urban areas a value of at least 30 mm/12 h is suggested. For forested areas the value should be 10 mm/12 h. Rain during the snowmelt should be added to the melt. If there is much rain in the autumn and soil temperatures are low before snow cover is formed, overland flow should take place from all surfaces in the late snowmelt period. If the soil is packed hard, the runoff may correspond to the melt rate.
W86-00097

2D. Evaporation and Transpiration

COMPARING THE PERFORMANCE OF ROOT-WATER-UPTAKE MODELS,
Katholieke Univ. Leuven (Belgium). Lab. of Soil Physics.
M. Alaerts, M. Badji, and J. Feyen.
Soil Science, Vol. 139, No. 4, p 289-296, April, 1985. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *Root-water-uptake models, *Soil water, *Model studies, Sink terms, Root-water-extraction terms, Hydrologic budget, Nitrogen budget, Transpiration, Nutrient removal, Nutrient uptake.

To model the water balance of a cropped soil, a root-water-extraction term, the so-called sink term, is added to the general flow equation describing the water flow in the unsaturated zone. To compare different proposed sink-terms, they should be used as variable components of the same field water budget model. Four root-water-extraction terms selected from the literature were adapted and inserted into the field water budget model SWATRE. The models were run with simplified initial and boundary conditions and showed agreement with regard to the cumulative water loss over a period of 20 d, if the input data and parameter values were adjusted. They resulted, however, in significantly different daily water-extraction-depth patterns. The most sophisticated model appears to contain a number of redundant terms, and the least complicated model could not be applied when a water table was present. The water-extraction-depth pattern is of special importance if the water budget model is used as a component of, for example, a nitrogen budget model. The simulated nutrient uptake will depend greatly on the moisture extraction pattern. Choice of sink term might be difficult under real field conditions and with validation data available. All sink terms require the choice of parameters adapted to the particular soil-plant combination. This almost automatically implies some data-fitting, because independent data for similar conditions are rarely available, and the knowledge for extrapolating from different conditions is lacking. Too little seems to be known about plant transpiration and water extraction patterns to result in a general extraction term which is simple and economical to use and satisfying in concept and results. (Collier-IVI)
W86-00048

2E. Streamflow and Runoff

NUMERICAL MODELLING OF SUBCRITICAL OPEN CHANNEL FLOW USING THE K-EPSILON TURBULENCE MODEL AND THE PENALTY FUNCTION FINITE ELEMENT TECHNIQUE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
A. N. Puri, and C. Y. Kuo.

Applied Mathematical Modelling, Vol. 9, No. 2, p 82-88, April, 1985. 8 Fig, 1 Tab, 21 Ref.

Descriptors: *Mathematical models, *Open-channel flow, *Turbulent flow, *Penalty function, *Finite element method, Curved channels, Flow, Channel flow, Momentum dispersion models, Turbulence closure models.

A numerical model has been developed that employs the penalty function finite element technique to solve the vertically averaged hydrodynamic and turbulence model equations for a water body using isoparametric elements. Solving of the full elliptic forms of the equations allowed recirculating flows to be calculated. Alternative momentum dispersion and turbulence closure models were evaluated by comparing model predictions with experimental data for strongly curved subcritical open channel flow. The results of these simulations indicate that the depth-averaged two-equation K-epsilon turbulence model yields excellent agreement with experimental observations. Neither the streamline curvature modification of the depth-averaged K-epsilon model, nor the momentum dispersion models based on the assumption of helicoidal flow in a curved channel, yield significant improvement in the present model predictions. Overall model predictions were found to be as good as those of a more complex and restricted three-dimensional model. (Author's abstract)
W86-00003

SPATIALLY VARYING RAINFALL AND FLOODRISK ANALYSIS,
Massachusetts Inst. of Tech., Cambridge.
R. L. Bras, D. R. Gaboury, D. S. Grossman, and G. J. Vicens.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 754-773, May, 1985. 10 Fig, 5 Tab, 7 Ref.

Descriptors: *Rainfall distribution, *Floodrisk analysis, *Flood forecasting, *Cumberland River Basin, *Kentucky, *Tennessee, *Simulation analysis, Model studies, Rainfall-runoff relationships, Discharge frequency.

A mathematical simulation model of the spatial and temporal rainfall process was developed and used to input to distributed rainfall-runoff models in order to obtain streamflow series at multiple locations in large river basins. Frequency analysis under different basin development and control alternatives can then be performed. A location in the Cumberland River Basin (Kentucky and Tennessee) was studied. The basin is 46,397 sq km (17,914 sq mile) and thus exhibits large rainfall variability in space. The rainfall model was calibrated with 28 yr of hourly and daily rainfall data in 274 stations in and around the basin. By using generated rainfall as input to a previously calibrated distributed rainfall-runoff model, discharge frequency curves were obtained at 14 locations. The curves corresponded to both the system with eight operational flood control reservoirs and the natural system without regulation. (Author's abstract)
W86-00012

METHOD OF PREDICTING DAILY PEAK FLOWS IN THE HIGH-FLOW SEASON,
Saskatchewan Univ., Saskatoon. Dept. of Geography.
P. R. Waylen.
Journal of Hydrology, Vol. 77, p 89-105, 1985. 7 Fig, 1 Tab, 21 Ref.

Descriptors: *Peak flows, *Flood forecasting, *Seasonal distribution, *British Columbia, Streamflow forecasting, Forecasting, Orographic precipitation, Data interpretation, Statistical analysis, Model studies.

Partial duration series provide a method of obtaining the distributions of both high-flow variables and annual floods. The seasonal nature of streamflow requires assumptions of nonhomogeneity of the timing of events. The modeling of timing is based upon the temporal behavior of high flows generated by distinct processes. The approach is physically meaningful and able to accommodate several generating processes. In southern British Columbia, Canada, snowmelt and rainfall produce high flows. Individually the distribution of each set of annual maxima produced by the respective processes are successfully represented by a double exponential distribution which, compounded, provide a good fit in locations of mixed generating processes. In all cases introduction of the time nonhomogeneity term to the double exponential for periods of less than 1 yr. provides a good fit to the observed distribution of daily peak flows throughout the high-flow season. (Author's abstract)
W86-00027

DISCRETE-TIME LINEAR CASCADE UNDER TIME AVERAGING,
National Hydrology Research Inst., Ottawa (Ontario).
For primary bibliographic entry see Field 2A.
W86-00028

GOULD'S PROBABILITY MATRIX METHOD; 1. THE STARTING MONTH PROBLEM,
Melbourne Univ., Parkville (Australia). Dept. of Civil Engineering.
R. Srikanthan, and T. A. McMahon.
Journal of Hydrology, Vol. 77, p 125-133, 1985. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Streamflow, *Gould's probability matrix, Australia, Rivers, Reservoirs, Probability distribution.

A major problem of water-supply authorities is to determine the relationship of the capacity of a large reservoir with its inflows and potential releases. Annual and/or monthly streamflow data for nine Australian rivers covering a range of characteristics are used to aid in solving this problem. Mean monthly flows (expressed as percentages of annual flow) and the annual coefficients of variation and lag-1 autocorrelation coefficients for different starting months are shown. Results based on synthetic data indicate that in Gould's probability matrix method the yearly routing of monthly flows should start in a month of low mean monthly flow. Results from historical data also indicated this, but are masked by the sample variability of the estimates. For analysis, the monthly data should be assembled into years defined by the water year which should begin and end normally during a time of low flow. (Baker-IVI)
W86-00029

GOULD'S PROBABILITY MATRIX METHOD; 2. THE ANNUAL AUTOCORRELATION PROBLEM,
Melbourne Univ., Parkville (Australia). Dept. of Civil Engineering.
R. Srikanthan, and T. A. McMahon.
Journal of Hydrology, Vol. 77, p 135-139, 1985. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Gould's probability matrix, *Streamflow, *Autocorrelation, Reservoirs, Water supply, Water storage, Flow.

The effect of lag-1 annual autocorrelation on storage sizes obtained from Gould's probability matrix method is examined using long sequences of generated data. The range of applicability of Gould's method and the associated correction factors for annual autocorrelation are proposed. The correction factor to take into account the annual autocorrelation coefficient was found to depend mainly on the annual lag-1 autocorrelation coefficient, r, and storage size. Except for a few limited combinations of r, annual coefficients of variation (Cv), and draft, the correlation factor is larger than 1.5, implying Gould's transition probability matrix method is not a suitable procedure for rivers with significant annual autocorrelation coefficients. Gould's procedure may be used for small r (0.2) so long as the correction factor is not greater than 1.5. Correction factors are presented. (Baker-IVI)
W86-00030

VARIANCE OF THE T-YEAR EVENT IN THE LOG PEARSON TYPE-3 DISTRIBUTION,
Asian Inst. of Tech., Bangkok (Thailand).
H. N. Phien, and L.-C. Hsu.
Journal of Hydrology, Vol. 77, p 141-158, 1985. 6 Tab, 11 Ref.

Descriptors: *Floods, *Rainfall, *Distribution, *Log Pearson type-3 distribution, Mathematical equations, Variance, Computers.

Detailed schemes for computing the variance of the T-yr. event, the variances and covariances of the parameter estimates for the LP3 distribution were described along with the provision of analytical formulae for all related computations. Variances and covariances are analytically derived in this study for the case where the parameters are estimated by the methods of direct and mixed moments. The examples given clearly show that the error committed in estimating the parameters of the LP3 distribution was very high, and the highest error seemed to take place in estimating the shape parameter. At present, an attempt is being made to apply the presented computational schemes to many more data sets of annual floods and annual maximum rainfalls, whereby general conclusions may be drawn on the performance of the different methods for parameter estimation. To help the evaluation process, a set of computer programs in FORTRAN have been developed according to the schemes presented in this paper. (Baker-IVI)
W86-00031

COMPARISON OF TWO DAILY STREAMFLOW SIMULATION MODELS OF AN ALPINE WATERSHED,
Colorado Univ. at Boulder. Dept. of Civil, Environmental, and Architectural Engineering.
C. M. Brendecke, D. R. Laiho, and D. C. Holden.
Journal of Hydrology, Vol. 77, p 171-186, 1985. 6 Fig, 2 Tab, 20 Ref.

Descriptors: *Alpine areas, *Streamflow, *Simulation, *Model studies, *Colorado, Computer models, Data interpretation, Hydrograph, Rainfall-runoff relationships, Hydrologic models.

A comparison of daily streamflow simulation by two different computer models has been completed for an alpine basin in central Colorado, U.S.A. The catchment is part of a 33-sq km area providing most of the City of Boulder's raw water supply. It is located between 2964 and 4103 m a.s.l. in elevation along the Continental Divide 24 km west of Boulder, Colorado. The Streamflow Synthesis and Reservoir Regulation model, which makes generous use of lumped-type parameters, was compared with the Precipitation Runoff Modeling System (PRMS) model, which makes greater use of individually defined parameters, by examining their respective ability to fit observed hydrograph volumes and shape. Both computer models were found to simulate streamflow equally well. The PRMS model was found to be more suitable overall because of its ability to handle small catchments and the generous use of individual physically-based parameters. (Author's abstract)
W86-00033

DETERMINATION OF RESISTANCE PARAMETERS OF PLUVIO-NIVO-GLACIAL ALPINE SYSTEMS BY MATHEMATICAL MODELING OF RUNOFF,
Vrije Univ., Amsterdam (Netherlands). Dept. of Hydrogeology and Geographical Hydrology.
A. A. Van De Griend, and E. Seyhan.
Journal of Hydrology, Vol. 77, p 187-207, 1985. 7 Fig, 1 Tab, 42 Ref.

Descriptors: *Alpine regions, *Mathematical models, *Runoff, *Hydrologic models, *Italy, Rainfall-runoff relationships, Glaciohydrology, Snowmelt, Geohydrology.

A nonlinear optimization technique has been applied to analyze complex hydrographs from an alpine catchment with pluvial, nival and glacial regime components, in order to determine bulk resistance parameters of the contributing systems. Both the fluvial system and the nivo-glacial system

are represented by a linear system function. Application of the optimization model to monthly time series of daily runoff, revealed the time variability of the systems operation which reflects the seasonal variability of hydro(geo)logical and snow-hydrological conditions relevant for the creation of runoff. The model has been applied to a northern Italian Alpine catchment with a runoff record of 22 yr. (Author's abstract)
W86-00034

MULTIPLE NONLINEAR STATISTICAL MODELS FOR RUNOFF SIMULATION AND PREDICTION,
Alcoa of Australia Ltd., Applecross.
E. N. Tsykin.
Journal of Hydrology, Vol. 77, p 209-226, 1985. 1 Fig, 3 Tab, 9 Ref, 3 Append.

Descriptors: *Statistical models, *Runoff, *Prediction, Model studies, Rainfall-runoff relationships, Hydrologic models, Soil water.

The lack of accuracy of statistical rainfall-runoff models is often caused by lack of correspondence between the nonlinear structure of the process and the linear structure of the statistical equation. Multiple nonlinear equations with separate antecedent soil-moisture indices for each time period and with a combined intercept allow the modeling of rainfall-runoff relations with high accuracy. The coefficients of determination between actual and simulated runoff for the calibration periods are typically higher than 0.90 and often as high as 0.96. Extrapolation over periods 3-4 times longer than the calibration have provided accurate predictions, with corresponding R2-values of 0.85 and higher. Extrapolations using these models are accurate even when the calibration period is relatively short and its range is smaller than the range of the predicted values. (Collier-IVI)
W86-00035

ESTIMATES OF PEAK RUNOFF FROM HILLY TERRAIN WITH VARIED LITHOLOGY,
International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
A. M. J. Meijerink.
Journal of Hydrology, Vol. 77, p 227-236, 1985. 6 Fig, 9 Ref.

Descriptors: *Peak runoff, *Runoff, *Topography, *Lithology, *Italy, *Spain, *India, *Tunisia, *Carinena, Slope-area method, Geomorphology, Streamflow, Rainfall distribution, Soil conservation.

Rainfall data for shorter durations may not be adequate in areas with strong relief; in such cases the common engineering formulas for the estimations of the peak discharges are difficult to apply. It may also not be feasible to use empirical formulas based on regression analyses from nearby regions. For estimating the peak flows one may have to resort to the use of the slope-area method and survey channel sections. Estimates of peak runoff were made using the slope-area method in hilly regions with poor adjustment of channel morphology to high flows. Geomorphological maps were made for each of four areas studied. The main units coincided with the geology and within each of the main units, channel reaches were surveyed. Small rivers were investigated in four areas: A basilicata area in southern Italy; the area around Carinena in central Spain; the area around Bata Nala-Renuka, Himachal Pradesh in north India; and the area around Kasserine in southwestern Tunisia. Despite the inaccurate nature of the methods, a meaningful interpretation of the results could be made. In the two Mediterranean areas the effects of the highly differing morpholithological units on the peak runoff could be demonstrated, although estimates of few catchments have been used. The method is not sensitive enough to reflect the effects of less pronounced morphologic variations and supposed geographic variations in rainfall intensities; this is indicated by the results of the area in northern India. In the semi-arid area of Kasserine the lithology and geomorphology did not seem to affect the peak flows with great return periods. The method may contribute to improved methods in soil and water conservation, and estimates of the capacities of cross-drainage works. An idea of the internal variation of direct response within larger catchments can also be obtained. (Collier-IVI)
W86-00036

CONDENSED DISAGGREGATION MODEL FOR INCORPORATING PARAMETER UNCERTAINTY INTO MOUTHLY RESERVOIR SIMULATIONS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. R. Stedinger, D. Pei, and T. A. Cohn.
Water Resources Research, Vol. 21, No. 5, p 665-675, May, 1985. 7 Fig, 5 Tab, 74 Ref. NSF grant CME 8010889.

Descriptors: *Reservoirs, *Simulation, *Boise River, *Rappahannock River, Model studies, Parameters, Distribution, Water supply, Water shortages, Reservoir failure.

A condensed version of the Valencia-Schaake disaggregation model was developed which describes the distribution of monthly streamflow sequences using a set of coupled univariate regression models rather than a multivariate time series formulation. The model is attractive because it has fewer parameters but can still reproduce the means, variances, and period to period correlations of the individual flows while approximately preserving the relationship among the monthly and annual flow values. The simple autoregressive form of the condensed disaggregation model facilitates the use of Bayesian inference theory to describe uncertainty as to the most appropriate values of the model's parameters. This allows construction of a two stage streamflow generation procedure which captures both the uncertainty as to what the model's parameters might be and the characteristics of flow sequences a model with those parameters might generate. The differences in estimates of reservoir system performance statistics due to the choice of different but reasonable models are generally relatively modest. The limited information available to estimate the parameters of the chosen model can have a striking and serious impact on the ability to specify how a given reservoir system is likely to perform in the future. Modeled sequences describe flows in the Rappahannock River in Virginia and the Boise River in Idaho. For high-reliability systems the results show that streamflow generation procedures which ignore model parameter uncertainty can grossly underestimate reservoir system failure rates and the severity of likely shortages, even if based on a 50-year record. (Baker-IVI)
W86-00073

INTERANNUAL STEAMFLOW VARIABILITY IN THE UNITED STATES BASED ON PRINCIPAL COMPONENTS,
Geological Survey, Reston, VA.
H. F. Lins.
Water Resources Research, Vol. 21, No.5, p 691-701, May, 1985. 8 Fig, 3 Tab, 20 Ref.

Descriptors: *Streamflow, *Variability, *Principal component analysis, Time series analysis, Flow, Autocorrelation.

Interannual modes of streamflow variation at 106 locations across the United States during the period 1931-1978 are defined by using principal components. Nearly 60% of the total variance could be explained by five principal components. Each component describes a spatially distinct mode of variation in terms of the departure of flows from period-of-record mean conditions. Thus the first principal component represents a uniform nationwide function; the second, a north-south opposition in flow departures; the third, an east-west opposition; the fourth, a coastal-continental opposition; and the fifth, a northern plains-southern plains opposition. Each successive principal component describes an increasingly more regional pattern of streamflow variation. These component patterns, especially the first three, exhibit considerable spatial stability based on similar analyses using altered data sets. Temporally, component stability is less certain, except in the case of the first component. Time series analysis of component scores indicates that most component functions are best described as AR(1) processes. Component four, the coastal-continental flow opposition function, appears to be an AR(2) process. Given the characteristics of principal components to describe the most organized modes of variation in a data set, it is not surprising that four of the first five components have stronger autocorrelation functions at low lags than does mean annual streamflow. Principal components can be used to identify the primary modes of variability in large multivariate fields of streamflow data. The principal components of streamflow exhibit more persistence than mean annual streamflow. For certain applications involving the analysis of large spatial and long temporal sets of flow data, parsimony without significant compromise in information may be achieved using principal components. (Baker-IVI)
W86-00076

RUNOFF FROM GLACIERIZED MOUNTAINS: A MODEL FOR ANNUAL VARIATION AND ITS FORECASTING,
Stirling Univ. (Scotland). Dept. of Environmental Science.
R. I. Ferguson.
Water Resources Research, Vol. 21, No. 5, p 702-708, May. 1985. 5 Fig, 3 Tab, 17 Ref.

Descriptors: *Snowmelt, *Runoff, *Glaciers, *Mountains, *Streamflow, Snow, Ice, Forecasting, Satellite technology, Snowcover, Snow accumulation, Remote sensing, Orographic variation.

For remote high mountain basins, such as the upper Indus in Pakistan, the only means of forecasting spring and summer runoff is from preseason snow cover on satellite images. Previous studies have shown that regression coefficients of runoff on snow cover differ between basins in magnitude and sign. A simple formal analysis of annual meltwater yield from high mountain basins explains why its relationship with preceding snow cover varies from basin to basin in sign and sensitivity and identifies a number of additional glacioclimatic parameters that are relevant but cannot be determined from preseason satellite imagery. A simple but flexible parameterization of orographic variation in snow accumulation and potential snowmelt enables prediction of annual meltwater runoff from the extent of winter snow cover, with bounds attached to allow for variation in summer heat input to glacier ablation zones. The moderating influence of glaciers on runoff gives way in highly glacierized basins to an inverse relationship between annual meltwater runoff and preceding snow cover. The critical glacier extent may be a slow as 10-20% where there is a strong orographic increase in snow accumulation. The value of satellite imagery for forecasting meltwater yield from high mountains would be improved by using late summer images to estimate glacierized areas, firn zone extent, and a latter's year to year variation. Even so there is still a need for ground investigation of the spatial, especially orographic, variation in snow accumulation and potential snowmelt. (Baker-IVI)
W86-00077

MINIMUM VARIANCE STREAMFLOW RECORD AUGMENTATION PROCEDURES,
Tufts Univ., Medford, MA. Dept. of Civil Engineering.
R. M. Vogel, and J. R. Stedinger.
Water Resources Research, Vol. 21, No. 5, p 715-723, May, 1985. 7 Fig, 4 Tab, 25 Ref.

Descriptors: *Floods, *Streamflow, *Variance, Estimating, Flood peaks, Sampling, Matalas-Jacobs estimators.

Augmentation procedures have been recognized as a useful approach for estimating the mean and variance of short hydrologic records. Approaches for augmentation of short-streamflow records have exploited the cross-correlation among flows at two or more gages to obtain maximum likelihood estimates of the mean and variance of the flows at the

hort-record gage. Estimators of the mean and ariance of the flows at a short record site were erived which should have lower variance than he unbiased maximum likelihood or Matalas-acobs estimators for the small samples of interest n hydrology. Since the Matalas-Jacobs estimators s well as the estimators introduced in this study equire an estimate of the flow's cross correlation , a Monte-Carlo experiment was performed to valuate the impact of using the sample cross-orrelation on their root mean square error (rmse). n general, these estimators have essentially an qual or, as is more often the case, a lower rmse han the Matalas-Jacobs estimators. The sampling roperties of estimators of the mean and variance f the flows at the short record site were exam-ned. The potential advantages and limitations of hese new estimators are discussed within the ramework of augmentation and/or extension of oth peak annual floods and also monthly stream-low records. (Baker-IVI)
V86-00079

NIT HYDROGRAPH APPROXIMATIONS SSUMING LINEAR FLOW THROUGH TOP-OLOGICALLY RANDOM CHANNEL NET-VORKS,
Geological Survey, Lakewood, CO. Water Re-ources Div.
. M. Troutman, and M. R. Karlinger.
Vater Resources Research, Vol. 21, No. 5, p 743-54, May, 1985. 4 Fig, 27 Ref, 1 Append.

Descriptors: *Runoff, *Drainage basins, *Flow, Unit hydrographs, Mathematical equations, La-place equation, Precipitation, Drainage, Surface low.

One of the important processes in defining runoff esponse of a drainage basin, movement of water n the surface through a channel network, is con-idered. Infiltration, subsurface flow, and overland low are not considered. The instantaneous unit ydrograph (IUH) of a drainage basin is expressed s a function of (alpha, beta, N), of (alpha, beta, N, D) and of (alpha, beta, N, M). The parameter alpha haracterizes the link (channel segment) lengths, eta is a hydraulic parameter, N is number of first-rder streams, D is diameter (mainstream length), nd M is order. Obtaining the IUH may involve umerical solution of the difference equation or umerical inversion of a Laplace transform. Both f these tasks, however, are readily performed on a igital computer. The IUH is derived based on ssumptions that the links are independent and dentically distributed random variables and that he network is a member of a topologically random opulation. Linear routing schemes, including ranslation, diffusion, and general linear routing are sed, and constant drainage density is assumed. By sing (N, alpha, beta) as the fundamental basin haracteristics, asymptotic (for large N) consider-tions lead to a Weibull probability density func-ion for the IUH. This asymptotic IUH is identical or all linear routing schemes. (Baker-IVI)
W86-00082

PROBABILISTIC STRUCTURE OF STORM SURFACE RUNOFF,
Universidad Simon Bolivar, Caracas (Venezuela). Graduate Program in Hydrology and Water Resources.
J. R. Cordova, and I. Rodriguez-Iturbe.
Water Resources Research, Vol. 21, No. 5, p 755-763, May, 1985. 7 Fig, 5 Tab, 8 Ref, 1 Append. Venezuela National Research Council grant S1-1212.

Descriptors: *Rainfall intensity, *Storm runoff, *Rainfall-runoff relationships, Probability, Storms, Infiltration, Mathematical equations.

The mean and variance of storm surface runoff are derived under the assumption that storm events are rectangular pulses with a bivariate exponential distribution for the intensity and duration of the storm. The Philip infiltration equation is used to make the transformation between rainfall and surface runoff. The probability of zero storm surface runoff mean and variance of storm surface runoff is also calculated under the same assumptions. The correlation between intensity and duration of the storm has an important impact on the probabilistic structure of storm surface runoff. The correlation between intensity and duration of the storm has an important impact on the probabilistic structure of storm surfce runoff. Equations are given which take into account such a correlation and provide the hydrologist with a way to estimate the mean and variance of storm surface runoff. It is not advisable to assume beforehand that intensity and duration are uncorrelated random variables, and an effort should be made to estimate the correlation between these climatic characteristics. The correlation between intensity and duration increases the probability of occurrence of storm surface runoff, which shows a significant increase for soil moisture contents above 60%. (Baker-IVI)
W86-00083

HYDROLOGICAL REGIONALISATION: A QUESTION OF PROBLEM AND SCALE,
Vrije Univ., Amsterdam (Netherlands).
I. Simmers, and E. Seyhan.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of FLorida, Gainesville. p 202-214, 6 Fig, 3 Tab, 20 Ref.

Descriptors: *Streamflow, *Runoff, *Hydrologic models, *Catchment areas, *Regional analysis, *Hydrologic data collection, *Surface runoff, Data collections, Model studies, Watersheds, Land use, Spatial distribution, Models, Topography.

Parameter prediction for ungauged catchment areas and regionalization of hydrological data depend on two fundamental issues - the problem to be resolved and the scale at which a solution is required. A simplified, dynamic method for regionalization of hydrological data is presented which encompasses these issues and is currently being applied to an ongoing study in east Luxembourg. Since the problem to be resolved in two catchments (the Tollbach and the Dosbach) involves prediction of hydrological response consequent upon land use change, the scale is small and requires the consideration of the dynamic spatial variation in discharge source areas. Data collection was initiated from a regionalized sampling matrix technique according to topography, vegetative cover, and nature of surficial deposits. The watershed is thus regarded as a system which consists of a series of homogenous units each contributing to runoff formation and streamflow generation. The described approach to regionalization is considered robust and, if combined with remote sensing, should minimize instrumental and data collection requirements.
W86-00096

ADVANCEMENT IN HYDRAULIC MODELING OF POROUS PAVEMENT FACILITIES,
Espey, Huston and Associates, Inc., Austin, TX.
G. F. Goforth.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January, 27-28, 1983, University of Florida, Gainesville. p 237-254, 8 Fig, 3 Tab, 5 Ref.

Descriptors: *Urban runoff, *Porous pavement, *Surface runoff, *Storm runoff, *Simulation analysis, *Drainage engineering, *Porous media, *Paving, *Hydraulic models, Runoff, Models, Model studies, Urban hydrology, Hydrologic budget, Storm seepage, Asphalt.

A porous pavement facility is an innovative solution to the problems of stormwater drainage from parking and other low density traffic areas in urban landscapes. Stormwater hydraulic characteristics of porous and nonporous pavement sites were evaluated using a revised version of the computer model PORPAV. PORPAV is a two-dimensional dynamic water budget analysis of a pavement facility which was initially developed for use in the EPA Storm Water Management Model. The utilization of PORPAV allows a comprehensive analysis of flow and storage in pavement facilities to aid in comparisons of the hydraulic response of alternative pavement designs. Monitoring surveys and stormwater simulations using PORPAV were carried out on three parking lots made of porous asphalt, gravel trench material, and conventional asphalt, respectively. Results showed that PORPAV satisfactorily simulated sprinkler-generated stormwater hydraulics of both porous and nonporous pavement facilities. Sprinkler application rates ranged from 0.4 to 1.7 inches/hr. Observed runoff ranged from 37 to 73% of recorded sprinkler inflow for the porous asphalt lot, 64 to 73% of recorded sprinkler inflow for the gravel trench lot and 71 to 118 volume % of recorded rainfall for the conventional asphalt lot.
W86-00098

TIME-OF-TRAVEL DATA FOR NEBRASKA STREAMS, 1968 TO 1977,
Geological Survey, Lincoln, NE. Water Resources Div.
L. R. Petri.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-602, 1984. 63 p, 17 Fig, 20 Tab, 6 Ref.

Descriptors: *Dye-tracing, *Time-of-travel measurements, *Surface-water discharge, *Nebraska, Streams.

This report documents the results of 10 time-of-travel studies, using 'dye-tracer' methods, conducted on five streams in Nebraska during the period 1968 to 1977. Streams involved in the studies were the North Platte, North Loup, Elkhorn, and Big Blue Rivers and Salt Creek. Rhodamine WT dye in a 20 percent solution was used as the tracer for all 10 time-of-travel studies. Water samples were collected at several points below each injection site. Concentrations of dye in the samples were measured by determining fluorescence of the sample and comparing that value to fluorescence-concentration curves. Stream discharges were measured before and during each study. Results of each time-by-travel study are shown on two tables and on graph. The first table shows water discharge at injection and sampling sites, distance between sites, and time and rate of travel of the dye between sites. The second table provides descriptions of study sites, amounts of dye injected in the streams, actual sampling times, and actual concentrations of dye detected. The graphs for each time-of-travel study provide indications of changing travel rates between sampling sites, information on length of dye clouds, and times for dye passage past given points. (USGS)
W86-00120

STREAMFLOW LOSSES ALONG THE BALCONES FAULT ZONE, NUECES RIVER BASIN, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
L. F. Land, C. W. Boning, L. Harmsen, and R. D. Reeves.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4168, 1983. 72 p, 36 Fig, 11 Tab, 4 Ref.

Descriptors: *Base flow, *Discharge measurement, Recharge, *Texas, *Streamflow losses, *Streamflow gains, Nueces River basin, Edwards aquifer.

An investigation was conducted to quantify and to determine distribution of streamflow losses and gains that occur during base flow conditions in the Balcones Fault Zone of the Neuces River basin. The streams studied include the West Nueces, Nueces, Dry Frio, Frio, and Sabinal Rivers, and Seco, Hondo, and Verde Creeks. Discharge measurements made during storm recession flows of these streams identified direct recharge to outcrops of the Edwards aquifer and related limestones that ranged from as high as 393 cubic feet per second for the Frio River to as low as 42 cubic feet per second for the Sabinal River. Recharge to outcrops of the Buda Limestone, Eagle Ford Shale, and Austin Group also eventually reaches the Edwards aquifer, and measurements identified losses to these formations ranging from as high as 174 cubic feet per second for the Frio River to near zero for Verde Creek. (USGS)

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W86-00124

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1981 VOLUME 1: NORTHEAST FLORIDA.
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00127

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1982, VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00128

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1981, VOLUME 1. HUDSON BAY BASIN.
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00129

WATER RESOURCES DATA HAWAII, OTHER PACIFIC AREAS, WATER YEAR 1981. VOLUME 2. GUAM, NORTHERN MARIANA ISLANDS, FEDERATED STATES OF MICRONESIA, PALAU ISLANDS AND AMERICAN SAMOA.
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00130

ATCHAFALAYA RIVER DELTA; REPORT 9: WIND CLIMATOLOGY,
Coastal Engineering Research Center, Vicksburg, MS.
For primary bibliographic entry see Field 2L.
W86-00163

ATCHAFALAYA RIVER DELTA; REPORT 8: NUMERICAL MODELING OF HURRICANE-INDUCED STORM SURGE,
Coastal Engineering Research Center, Vicksburg, MS.
For primary bibliographic entry see Field 2A.
W86-00164

PRELIMINARY USER'S MANUAL 3-D MATHEMATICAL MODEL OF COASTAL, ESTUARINE, AND LAKE CURRENTS (CELC3D),
Aeronautical Research Associates of Princeton, Inc., NJ.
Y. P. Sheng.
Instruction Report D-84-1, April 1984. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. 52 p, 10 Fig, 3 Tab, 11 Ref, 2 Append.

Descriptors: *Finite difference methods, *Mathematical models, *Water currents, *Fluid mechanics, *Computer models, Models, Model studies, Hydrologic models, Simulation analysis, Estuaries, Lakes, Differential equations, Mathematical studies, Coastal waters.

An efficient and comprehensive three-dimensional finite-difference model of coastal, estuarine, and lake currents (CELC3D) has been developed and is currently operative on a VAX-11/780 minicomputer. This user's manual discusses the special model features, general structure of the CELC3D computer code, sub-program summary, input/output data, and data requirements, and gives an example calculation by simulating the tide- and wind-driven currents in the Mississippi coastal water of the Gulf of Mexico. The CELC3D code can be used for the computation of two- or three-dimensional unsteady currents in coastal, estuarine, or lake waters based on the free-surface model described in detail by Sheng (1983). The present version of the code contains no buffering scheme and is programmed to run entirely in the central memory. The CELC3D program solves the mean equations of fluid motion within a water body with respect to a right-handed Cartesian coordinate system located at the nominal water surface. These equations consist of the partial differential equations for surface displacement, vertically integrated velocities, three-dimensional velocities, temperature, salinity, density, and sediment concentration.
W86-00168

CURRENT MEASUREMENTS IN THE COLUMBIA RIVER ESTUARY,
Chalmers Univ. of Technology, Goeteborg (Sweden). Institutionen foer Kaernkemi.
For primary bibliographic entry see Field 2L.
W86-00181

DEVELOPMENT OF A NUMERICAL MODELING CAPABILITY FOR THE COMPUTATION OF UNSTEADY FLOW ON THE OHIO RIVER AND ITS MAJOR TRIBUTARIES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
B. H. Johnson.
Technical Report HL-82-20, August 1982. Final Report. 154 p, 83 Fig, 7 Tab, 8 Ref, 3 Append.

Descriptors: *Rivers, *Flow characteristics, *Navigation, *Locks, *Dams, Model studies, Mathematical models, Unsteady flow, Ohio River, Reservoir operation, Tributaries, Flood control, FLOWSED model, Levees, Sediment transport.

The FLOWSED model is a one-dimensional mathematical model for predicting open-channel unsteady flow conditions and sediment movement on the Ohio River. In this work the coefficients were selected to minimize sediment transport. FLOWSED, an implicit finite difference model, can be used to model a system containing any number of tributaries. The influences of locks and dams as well as levee overtopping are also included. This model cannot be applied to multiple connected systems with closed loops or distributary channels. FLOWSED was applied to the complete Ohio River systems, broken into four separate segments, in a calibration mode. Historical data from floods in 1964, 1972, and 1976 were used. Results at gages varied from excellent to encouraging. However, poor results were obtained on tributaries where crude geometry data were used.
W86-00220

CHANNEL WIDTHS IN BENDS AND STRAIGHT REACHES BETWEEN BENDS FOR PUSH TOWING: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-00225

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER: RIVER MILE 480-530; REPORT 6: LARVAL FISH STUDIES PILOT REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 6G.
W86-00226

GUIDE TO STREAM HABITAT ANALYSIS USING THE INSTREAM FLOW INCREMENTAL METHODOLOGY,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
For primary bibliographic entry see Field 6G.
W86-00251

2F. Groundwater

DISPERSION IN ANISOTROPIC, HOMOGENEOUS, POROUS MEDIA,
Baghdad Univ. (Iraq). Coll. of Engineering.
Q. N. Fattah, and J. A. Hoopes.
Journal of Hydraulic Engineering, Vol 111, No. 5, p 810-827, May, 1985. 6 Fig, 1 Tab, 28 Ref, 1 Append.

Descriptors: *Dispersion, *Anisotropic media, *Homogenous media, *Porous media, *Groundwater movement, *Flow, Sand, Tensor models, Vectors, Model studies, Particle size, Path of pollutants.

A tensor model for the dispersion coefficient for saturated flow in anisotropic, homogeneous porous media was developed through evaluations of tensor components from experiments with an anisotropic, homogenous porous medium, constructed from thin, alternating layers of two types of sand, having different mean particle sizes. Tests were conducted for flow parallel, perpendicular, and inclined at 60 degrees to the direction of the layers. The hydraulic conductivity and the longitudinal dispersion coefficient were second-rank tensors with equal and constant eccentricities and with major and minor principal axes oriented along and perpendicular to the direction of the sand layers, respectively. The lateral dispersion coefficient was a second-rank tensor whose principal axes were orthogonal to those of the hydraulic conductivity tensor and whose eccentricity increased with increasing seepage velocity. Two values of the off-principal diagonal dispersivities were nearly equal in magnitude but opposite in sign. Experimental results support the dispersion coefficient tensor model proposed in the investigation. (Author's abstract)
W86-00015

FIELD OBSERVATIONS AND NUMERICAL EXPERIMENTS ON A DRYING FRONT IN A VOLCANIC ASH SOIL CALLED KANTO LOAM,
Rissho Univ., Tokyo (Japan). Dept. of Geography.
M. Higuchi.
Journal of Hydrology, Vol. 77, p 253-262, 1985. 5 Fig, 4 Ref.

Descriptors: *Drying fronts, *Soil water, *Volcanic ash soil, *Kanto loam, *Japan, *Evaporation, *Numerical analysis, Mathematical studies, Solar radiation, Wind, Boundary conditions, Loam.

Field observations (in Japan) and numerical experiments were carried out to investigate the formation and advance of a drying front in a volcanic ash soil called Kanto loam in an evaporation-drying process. The drying front is a boundary between an upward flux zone above and a downward flux zone beneath. In field observations of an evaporation-drying process from August 27 to September 8, 1977 in the Kanto loam, drying fronts formed quite near the soil surface and shift down to a depth of 100 cm. Numerical experiments for four different evaporation rates (respec. 1.25, 2.5, 5 and 10 mm/day) indicated that drying fronts advance downward to a depth of approximately 100 cm in 10 days. The computed depths of the drying fronts for an evaporation rate of 2.5 mm/day agree well with the observations. (Author's abstract)
W86-00038

BLOCK-GEOMETRY FUNCTIONS CHARACTERIZING TRANSPORT IN DENSELY FISSURED MEDIA,
British Geological Survey, Wallingford (England).
J. A. Baker.
Journal of Hydrology, Vol. 77, p 263-279, 1985. 2 Fig, 2 Tab, 22 Ref, 2 Append.

Descriptors: *Block-geometry functions, *Saturated zone, *Groundwater movement, *Solute transport, Diffusion, Heat, Geologic fractures, Path of pollutants, Laplace equation, Aquifers, Fick's law, Darcy's law, Fourier's law, Fourier analysis.

Three forms of transport are of importance in aquifers and saturated soils: transport of the water itself; transport of solutes in the water; and transport of heat by the water. Transport in saturated media can be considered to consist of densely packed blocks of matrix material separated by fis-

ures. The equations describing transport in fis-ured media, where transport in the matrix blocks s diffusive, are reduced to the standard form of a ifferential equation for the fissure phase. Trans-ort in the matrix material is assumed to be diffu-ive which requires the following conditions to pply in the above three cases, respectively: water low in the porous matrix is described by Darcy's aw; water is stationary in the porous matrix and he solute transport is described by Fick's law; and vater is stationary in the matrix, if it is porous, and eat transport is described by Fourier's law. Under hese commonly assumed conditions the mathemat-cal description of transport in the matrix phase vill be the same in all three cases. The transport equations can be reduced to a differential equation or transport in the fissure phase along with its oundary conditions. This equation contains a di-nensionless function, the block-geometry function, which contains all the relevant information regard-ng the geometry of the matrix blocks. Several uch block-geometry functions were derived for imple shapes and for mixtures of these shapes. Empirical generalizations to irregular geometries were proposed on the basis of the commmon prop-rties of these functions. The quasi-steady-state nodel of fissure-maxtrix interaction can also be ormulated within this mathematical framework, nd can be readily compared with the diffusive nodel, especially with regard to asymptotic behav-or. Numerical Laplace transform inversion should e used for evaluation of the potential (head, con-entration or temperature) except when the analyt-c solution is very simple. (Collier-IVI)
W86-00039

HYDRAULICS OF A WELL PUMPED WITH LINEARLY DECREASING DISCHARGE,
Govind Ballabh Pant Univ. of Agriculture and Technology, Plantnagar (India). Dept. of Irriga-ion and Drainage Engineering.
H. C. Sharma, H. S. Chauhan, and S. Ram.
Journal of Hydrology, Vol. 77, p 281-291, 1985. 7 Fig, 10 Ref.

Descriptors: *Hydraulics, *Discharge, *Wells, *Pumping, *Formation constants, *Aquifers, Theis equation, Cooper-Jacob equation, Model studies.

Varying the discharge rate of a well with time makes the Theis and Cooper-Jacob methods inap-plicable for determination of the formation con-stants of an aquifer. Analytical and graphical solu-tions for variable discharge cases are available for a few empirical or functional relationships. A number of other modes of variation of discharge with time are physically possible. A method was developed with the help of analytical and graphi-cal solutions to determine aquifer constants by pumping the well with linearly decreasing dis-charge. The linearly decreasing discharge was sim-ulated on a horizontal Hele-Shaw model. The transmissivity and storage coefficient were evaluat-ed by using the type curve developed for a linearly decreasing discharge well. The solution gave fairly satisfactory values of aquifer constants. (Author's abstract)
W86-00040

ANALYTICAL SOLUTIONS FOR PERIODIC WELL RECHARGE IN RECTANGULAR AQUIFERS WITH THIRD-KIND BOUNDARY CONDITIONS,
Thessaloniki Univ., Salonika (Greece). School of Technology.
P. Latinopoulos.
Journal of Hydrology, Vol. 77, p 293-306, 1985. 7 Fig, 1 Tab, 11 Ref.

Descriptors: *Recharge, *Rectangular aquifers, *Aquifers, *Third-kind boundary conditions, *Boundary conditions, *Mathematical studies, Groundwater movement, Seasonal variation, Arti-ficial recharge, Groundwater recharge, Perched aquifers.

Analytical solutions of groundwater flow in con-fined and unconfined homogeneous and isotropic aquifers are especially useful in understanding the physical processes on a local scale, as well as in checking numerical solutions for large-scale prob-lems. Analytical solutions for groundwater flow in rectangular aquifers with third-kind boundary conditions in the case of a single-well recharging sea-sonally under any form of continuously varying recharge regime. The solutions can be used for a preliminary assessment of the groundwater re-sponse to artificial recharge schemes upon either perched aquifers or aquifers in contact with clogged river beds. Depending upon the desired final management goals, the most suitable recharge regime can be selected by trying various types of recharge rate variations at a first stage. The solu-tions can be used to check numerical solutions of large and more complex problems. (Collier-IVI)
W86-00041

REGIONAL UNSTEADY INTERFACE BE-TWEEN FRESH WATER AND SALT WATER IN A CONFINED COASTAL AQUIFER,
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
K. Inouchi, Y. Kishi, and T. Kakinuma.
Journal of Hydrology, Vol. 77, p 307-331, 1985. 12 Fig, 19 Ref.

Descriptors: *Saline-freshwater interface, *Coastal aquifers, *Confined aquifers, *Model studies, *Naka river estuary, *Kiki river estuary, *Japan, Aquifers, Groundwater level, Water level, Mathe-matical equations, Boundary conditions.

An areal two-dimensional model to describe the unsteady motion of the fresh-salt water interface and the groundwater level in a confined coastal aquifer was applied to the confined groundwater in the estuaries of the Naka and Kiki rivers in Japan. Two equations were derived starting from the basic equations of the groundwater flow; one equa-tion of the effective water level and one equation of the interface. The first equation describes a very rapid variation of the effective groundwater level and the second equation describes a very slow variation of the interface with time. In order to find solutions of these equations under the bounda-ry conditions in practical field problems, the nu-merical scheme based on Galerkin finite-element technique was employed. Using this numerical scheme, transient positions of the groundwater level and the interface were calculated in the above-mentioned two regions and compared with the available field data. The calculated results agreed well with the data. (Author's abstract)
W86-00042

TWO ALGORITHMS FOR PARAMETER ESTI-MATION IN GROUNDWATER FLOW PROB-LEMS,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
F. C. Van Geer, and P. Van Der Kloet.
Journal of Hydrology, Vol. 77, p 361-378, 1985. 7 Fig, 1 Tab, 4 Ref.

Descriptors: *Algorithms, *Groundwater move-ment, *Piezometric head, *Model studies, Darcys law, Kalman filtering, Mathematical studies, Pumping tests.

In groundwater flow problems the system varia-bles are groundwater levels, piezometric levels and water velocities. The state of the system is defined in accordance with the continuous or discrete for-mulation of the variables which describe the groundwater flow model in time and space. Groundwater movement is often described by equations based on Darcy's law and the equation of continuity. These equations contain a number of lumped parameters, representing the properties of the soil. These parameters are not known and have to be estimated from field measurements (eg, pumping tests) or from calculations. Groundwater movement can be described by one lumped parame-ter; two algorithms were developed to estimate that parameter based upon an optimal-state estima-tion with a standard Kalman filter algorithm. In both methods, existing series of groundwater levels/piezometric levels can be used. The two algorithms were applied to an example with gener-ated data. The estimation methods may be ex-tended to cases with more than one parameter. Both methods allow insight in the variance of the parameter and in the reliability of the calculation results of the hydrological model. (Collier-IVI)
W86-00044

ALTERNATING DIRECTION GALERKIN TECHNIQUE FOR SIMULATION OF CON-TAMINANT TRANSPORT IN COMPLEX GROUNDWATER SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W86-00072

ANALYSIS AND INTERPRETATION OF SINGLE-WELL TRACER TESTS IN STRATI-FIED AQUIFERS,
Auburn Univ., AL. Dept. of Civil Engineering.
O. Guven, R. W. Falta, F. J. Molz, and J. G. Melville.
Water Resources Research, Vol. 21, No. 5, p 676-684, May, 1985. 18 Fig, 22 Ref.

Descriptors: *Aquifer testing, *Advection, *Dis-persion, Tracers, Model studies, Mathematical equations, Contamination, Path of pollutants, Groundwater pollution.

The definition and measurement of the dispersive properties of a stratified aquifer are investigated based on the single-well tracer test. In the single well test, tracer is pumped into the formation for a period of time and then pumped out. Concentra-tion data are obtained from the injection-with-drawal well and from one or more sampling obser-vation wells which may be multilevel. The analysis of such a test is based on a Lagrangian-Eulerian numerical model which considers the depth-de-pendent advection in the radial direction and local hydrodynamic dispersion in the vertical and radial directions. The movement of an injected tracer in a stratified aquifer may be accurately simulated with-out resorting to the use of a scale-dependent, full aquifer dispersivity if the flow field is known in sufficient detail. When the advection process is simulated accurately, the values of local dispersi-vity will be small, constant, and on the order of those measured in the field or lab at individual levels in the aquifer. The full aquifer breakthrough curves measured in observation wells in a single well test in a stratified aquifer are determined by the hydraulic conductivity profile in the region between the injection withdrawal well and the observation well if the travel distance between these wells is typical of most test geometries. The relative concentration versus time data recorded at the injection withdrawal well during the with-drawal phase is primarily a measure of mixing in the aquifer due to local dispersion which has taken place during the experiment. The amount of mixing will depend on both the hydraulic conduc-tivity distribution in the aquifer and the size of the experiment. As the experiment scale increases, the effects of local vertical dispersion will become larger compared to the effects of local radial dis-persion. Local vertical dispersion will cause solute traveling in a high conductivity layer in an aquifer to migrate into adjacent low-conductivity layers where its movement will be relatively slow in comparison. In the initial design of a tracer test it is important to have some idea of the type of nonho-mogeneity which is present. More information of a broad nature concerning the types or classifica-tions of nonhomogeneities that exist in natural aquifers is needed. (Baker-IVI)
W86-00074

STRATIGRAPHY AND SEDIMENTARY FACIES OF THE MADISON LIMESTONE AND ASSOCIATED ROCKS IN PARTS OF MON-TANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, WYOMING,
Geological Survey, Rolla, MO. Water Resources Div.
J. A. Peterson.
Available from the Distr. Br., USGS, 604 So. Pickett St., Alexandria, VA 22304. USGS Profes-sional Paper 1273-A, 1984. 83 p, 34 Fig, 2 Tab, 88 Ref.

Descriptors: *Stratigraphy, *Hydrogeology, *Aquifers, Geologic units, Facies (Sedimentary), *Carbonate rocks, *Groundwater resources, *Sedimentary basins (Geologic), Permeability, *Madison Limestone, Paleogeography, Paleostructure, *Marker Beds, Reefs, *Carbonate Mounds, Montana, North Dakota, South Dakota, Wyoming, Nebraska.

The Madison Limestone study was begun in 1976 to evaluate the Madison Limestone and associated rocks as possible sources of water for the development of coal resources in the Northern Great Plains. Paleozoic sedimentary rocks in this area include a sequence of mostly shallow-water marine carbonate, clastic, and evaporite deposits of Middle Cambrian through Late Permian age. Upper Ordovician through Upper Mississippian rocks are primarily carbonate beds containing porous units, mainly dolomite or dolomitic limestone, which are widespread but discontinuous. The Devonian and Mississippian sediments are cyclic deposits, and the Mississippian carbonate rocks can be divided into at least 13 carbonate-evaporite marker-defined cyclic units, based on the common occurrence of shaly marker beds, identified on geophysical logs. The Upper Paleozoic rocks are dominated by clastic rocks, beginning with the marine shales, carbonates, redbeds and evaporites of the Upper Mississippian and ending with the relatively thick marine and aeolian sandstones, red beds, and evaporites of Pennsylvanian and Permian age. Thick, porous sandstone beds occur in Upper Pennsylvanian and Lower Permian rocks of Wyoming, southeastern Montana, northwestern South Dakota, and southwestern North Dakota. (USGS)
W86-00104

ANALYSIS AND INTERPRETATION OF DATA OBTAINED IN TESTS OF THE GEOTHERMAL AQUIFER AT KLAMATH FALLS, OREGON,
Geological Survey, Menlo Park, CA. Water Resources Div.
E. A. Sammel.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4216, 1984. 151 p, 65 Fig, 7 Tab, 68 Ref.

Descriptors: *Hydrogeology, *Reconnaissance, *Geothermal resource, Evaluation, Geology, *Oregon, Klamath County, Klamath Falls.

Water with temperatures to 130 C occurs in an extensive, heterogeneous aquifer at depths of a few hundred to nearly 2,000 feet. Chemical and isotopic analyses suggest that 190 C water mixes with cooler recharge water in a ratio of about 2 to 3 in zone within and beneath the aquifer. The water spreads from a fault zone and is tapped for space heating by more than 450 wells over a 2 square-mile area. Data obtained during a 50-day pumping and reinjection test in July and August, 1983, were fitted to theoretical double-porosity type curves. Predictions of water-level changes were made for two hypothetical pumping and reinjection schemes. It was determined that reinjection can generally offset declines due to pumping, although water levels will decline near pumped wells and will rise near injection wells. Tracer tests confirmed the double-porosity behavior of the aquifer. Discharge from thermal wells averages about 540 gallons per minute and heat discharge is about 18 x 10 to the 12th power British Thermal Units per year. Down-hole heat exchangers discharge about 13 x 10 to the 10th power British Thermal Units per year. Additional development probably is feasible. (USGS)
W86-00107

WATER RESOURCES ON THE PUEBLO OF LAGUNA, WEST-CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
D. W. Risser, and F. P. Lyford.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4038, 1983. 308 p, 42 Fig, 17 Tab, 45 Ref.

Descriptors: *Groundwater availability, *Surface water availability, *Groundwater movement, *Water quality, Computer modeling, *Aquifer testing, Pueblo of Laguna, *New Mexico, Bernalillo, Sandoval County, Valencia County, Cibola County, Rio San Jose Basin.

This study evaluates the quality and quantity of water available on the Pueblo of Laguna, New Mexico. Groundwater for public supply occurs in the valley fill along the Rio San Jose, in the Paguate and Encinal areas, and possibly in the northern part of the Sedillo Grant. The valley fill in the Rio San Jose will supply 50 to 450 gallons per minute of potable water to properly constructed wells. In the alluvium along Rio Paguate, additional development of as much as 250 gallons per minute is possible. Groundwater for irrigation is restricted by available yields and quality to the valley fill along the Rio San Jose and possibly the western part of the Major's Ranch area. In the Rio San Jose valley yields of 50 to 450 gallons per minute of water containing 500 to 3,000 milligrams per liter are possible. Digital-model simulations of the valley-fill aquifer west of the Village of Laguna show a potential salvage of as much as 900 acre-feet per year of evapotranspiration losses if water levels are lowered. Model studies also indicate that the winter flow of the Rio San Jose could be used to recharge groundwater stored in the valley. (USGS)
W86-00108

GROUND-WATER RESOURCES OF AUDRAIN COUNTY, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
L. F. Emmett, and J. L. Imes.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-245, 1984. 55 p, 38 Fig, 8 Tab, 34 Ref.

Descriptors: *Computer model, *Groundwater movement, Groundwater irrigation, *Drawdown, *Potentiometric surface, Wells, Water supply, Groundwater availability, *Missouri, Audrain County, Enroachment, Water use, Water quality, Consolidated aquifer.

The deep (principal) aquifer in Audrain County has an average thickness of about 1,300 feet and is composed of dolomite and minor quantities of sandstone of Cambrian and Ordovician age. The deep aquifer is the source of water for all public-supply and irrigation wells in Audrain County. Pumpage from the deep aquifer has caused a decrease in hydraulic head of more than 200 feet since 1900 in the vicinity of the city of Mexico. Calculations from a two-dimensional digital model of the deep aquifer indicate that the drawdown would increase 10 to 25 feet from May 1979 levels in Audrain County by May 2000 in the absence of irrigation pumpage and if public-supply wells continue to pump at the 1980 rate. If the additional stress due to seasonal irrigation is continued at 1980 pumping rates, 60 +/- 20 feet of drawdown is predicted by May 2000. Audrain County is the northernmost extent of freshwater in this aquifer in Missouri. In Audrain County the dissolved-solids concentration of water from this aquifer varies from 1,200 milligrams per liter in the north to less than 400 milligrams per liter in the south. Lowered water levels in the aquifer may allow water with a larger dissolved-solids concentration to move into the area. (USGS)
W86-00113

WATER TABLE IN ROCKS OF CENOZOIC AND PALEOZOIC AGE, 1980, YUCCA FLAT, NEVADA TEST SITE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
G. C. Doty, and W. Thordarson.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4067, 1983. 1 p (cover), 1 Fig (map).

Descriptors: *Water table, *Maps, *Nevada, Groundwater resources, Hydrogeology, Yucca Flat, Nevada Test Site, *Nye County.

The water table at Yucca Flat, Nevada Test Site Nevada, occurs in rocks of Paleozoic age and in tuffs and alluvium of Cenozoic age and ranges in altitude from about 2,425 feet to about 3,500 feet The configuration of the water table is depicted by contours with intervals of 25 to 500 feet. Control for the map consists of water-level information from 61 drill holes, whose locations and age of geologic units penetrated are shown by symbols on the map. (USGS)
W86-00116

GROUND-WATER CONDITIONS IN THE COTTONWOOD-WEST OAKLEY FAN AREA SOUTH-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
T. K. Edwards, and H. W. Young.
Available from the OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4140, 1984. 32 p, 12 Fig, Tabs, 22 Ref.

Descriptors: *Groundwater development, *Water table decline, *Groundwater depletion, Groundwater barriers, *Aquifer testing, *Overdraft *Idaho, Golden Valley, Cottonwood-West Oakley Fan, Rock Creek Hills, Critical Groundwater Area.

Intensive groundwater development in the Cottonwood-West Oakley Fan area, Cassia County Idaho, has resulted in rapid water-level decline and establishment of two critical groundwater areas. A northwest-trending fault in nearly coincident with the boundary between the two critical groundwater areas. Southwest of the fault, water levels in limestone are as much as 200 feet higher than those in silicic volcanics northeast of the fault which indicates the fault is an effective barrier to groundwater movement. Results of an aquifer test in limestone southwest of the fault further indicate no hydraulic connection with the silicic volcanic aquifer northeast of the fault. Water levels in wells completed in limestone and silicic volcanic aquifers have declined 5 and 5.5 feet per year since 1977. Groundwater withdrawals in 1980 were about 60,000 acre-free from the silicic volcanic aquifer and, between 1977 and 1982, average about 5,300 acre-feet per year from the limestone aquifer. Annual recharge to the silicic volcanic aquifer is between about 10,000 and 26,000 acre-feet; recharge to the limestone aquifer is near 4,000 acre-feet. Limited water-quality data indicate that groundwater is chemically suitable for irrigation and domestic use. (USGS)
W86-00117

STREAMFLOW LOSSES ALONG THE BALCONES FAULT ZONE, NUECES RIVER BASIN, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-00124

AVAILABILITY OF WATER FROM THE ALLUVIAL AQUIFER IN PART OF THE GREEN RIVER VALLEY, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, II, R. C. Alvord, and B. W. Drost.
Available from the OFSS, USGS, Box 2542 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4178, 1984. 38 p, 12 Fig, Tab, 5 Ref.

Descriptors: *Computer model, Groundwater availability, *Groundwater, *Well yield, Water resources development, Streamflow depletion, *Surface-groundwater relationships, Potential water supply, *Alluvial aquifers, Green River, King County, *Washington.

The Muckleshoot Indian Tribe plans (1982) to build a fish hatchery in part of a 1.56-square-mile area in the Green River valley, Washington, and use groundwater to operate it. Groundwater da

were collected in the area and used in a U.S. Geological Survey two-dimensional groundwater-flow model calibrated to simulate the groundwater-flow system in the study area. Measured water levels in the alluvial aquifer were simulated to within 1 foot at 7 of 12 observation wells, and within 2 feet at all 12 wells. When pumping from the aquifer was simulated with the model, it was found that all water pumped from wells was derived from induced leakage from the Green River into the alluvium and reduced leakage through the alluvium to the Green River. Pumping from the alluvium may also reduce the flow of a tributary to the Green River. (USGS)
W86-00126

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1981 VOLUME 1: NORTHEAST FLORIDA.
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00127

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1982, VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00128

WATER RESOURCES DATA HAWAII, OTHER PACIFIC AREAS, WATER YEAR 1981. VOLUME 2. GUAM, NORTHERN MARIANA ISLANDS, FEDERATED STATES OF MICRONESIA, PALAU ISLANDS AND AMERICAN SAMOA.
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00130

NATURAL GROUND-WATER-RECHARGE DATA FROM THREE SELECTED SITES IN HARVEY COUNTY, SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. A. Perry.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-457, 1984. 31 p, 7 Fig, 7 Tab, 4 Ref.

Descriptors: *Data collections, Soil water, *Groundwater level, Rainfall, *Recharge, *Kansas, Equus beds, Recharge data.

The cities of Wichita, Newton, and several smaller towns pump large quantities of water from the 'Equus Beds' aquifer in south-central Kansas. The aquifer also supplies large quantities of water for irrigation at a steadily increasing rate. The Harvey County Planning and Zoning Commission entered into a cooperative agreement with the U.S. Geological Survey to collect information on natural recharge at three sites having different soils and unsaturated lithologies. Data summarized in tabular form include daily rainfall amounts, average soil moisture for selected layers, water-table levels, and neutron-measured soil moisture at 1-foot intervals. This information can be used in studying the possibility of protecting the aquifer from any development that might impede natural recharge. (USGS)
W86-00132

USER'S GUIDE FOR A PLANE AND AXISYMMETRIC FINITE ELEMENT PROGRAM FOR STEADY-STATE SEEPAGE PROBLEMS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Automatic Data Processing Center.
For primary bibliographic entry see Field 2G.
W86-00156

PUBLIC WATER SUPPLIES IN GLOUCESTER COUNTY, N.J.,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
W. F. Hardt.
Water Resources Circular No. 9, New Jersey State Dept. of Conservation and Economic Development, 1963. 55 p, 4 Fig, 5 Tab, 8 Ref.

Descriptors: *Municipal water, *Water supply, *Water demand, *Water use, *Potential water supply, Water quality, Groundwater, Water conveyance, Aquifers, Geohydrology, Pumping plants, Saline water intrusion.

Gloucester County is part of the Lower Delaware River Valley in New Jersey. This area is attracting new industry and has shown a population increase of about 47% from 1950-1960. The availability and quality of water is becoming more important with the economic growth of the county. Gloucester County is underlain by unconsolidated sands and clays of Quaternary, Tertiary, and Cretaceous age. The Raritan and Magothy Formations constitute the most important aquifers and yield more than 95% of the water pumped by the public water systems in the county. These formations are capable of yielding 1,400 gallons per minute (gpm) or more to large diameter wells. The overall chemical quality of the groundwater is good. Contamination of groundwater by salt-water encroachment or by pollution from industrial activity or organic waste in densely populated areas should be prevented. The 21 public water systems in Gloucester County realized 100% increase in pumped water from 1948 to 1959. The history of the present installations, groundwater conditions, quality and availability of water, and potential future yield for the 21 public water systems in Gloucester County are summarized.
W86-00174

SEEPAGE ANALYSIS USING THE BOUNDARY ELEMENT METHOD,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2G.
W86-00228

2G. Water In Soils

SOIL MOISTURE CONTENT: STATISTICAL ESTIMATION OF ITS PROBABILITY DISTRIBUTION,
Kozponti Meteorologiai Intezet, Budapest (Hungary).
T. Farago.
Journal of Climate and Applied Meteorology, Vol. 24, No. 4, p 371-376, April, 1985. 3 Fig, 29 Ref.

Descriptors: *Soil water, *Statistical analysis, *Precipitation, Surface water, Markov process, Mathematical studies, Meteorology.

The simplified surface-water balance equation was generalized so as to express the probability distribution of its soil moisture component in a recurrence form; an extended probability model for soil moisture was derived based on a chain-dependent model for precipitation. A similar equation was deduced for the first moments as well. The consideration of the stochastic dependence of the consecutive daily precipitation amounts is usually unavoidable for periods essentially shorter than one month. Gamma distributions were used in fitting the stochastic variables of daily precipitaiton amounts. The model could have been solved only in an approximate numerical way due to its complexity. Nevertheless, either the distribution function, or, in a simpler case, the mean value of soil moisture can effectively be estimated given all parameters of the Markov process of daily precipitation, an initial value of the soil moisture and the coefficient of parameterization of other terms in the water balance equation. Such a parameterization is acceptable under the conditions of insufficient humidification. The model is illustrated by a numerical example. (Collier-IVI)
W86-00021

BLOCK-GEOMETRY FUNCTIONS CHARACTERIZING TRANSPORT IN DENSELY FISSURED MEDIA,
British Geological Survey, Wallingford (England).
For primary bibliographic entry see Field 2F.
W86-00039

COMPARING THE PERFORMANCE OF ROOT-WATER-UPTAKE MODELS,
Katholieke Univ. Leuven (Belgium). Lab. of Soil Physics.
For primary bibliographic entry see Field 2D.
W86-00048

INFILTRATION UNDER PONDED CONDITIONS: 1. OPTIMAL ANALYTICAL SOLUTION AND COMPARISON WITH EXPERIMENTAL OBSERVATIONS,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
J. Y. Parlange, R. Haverkamp, and J. Touma.
Soil Science, Vol. 139, No. 4, p 305-311, April, 1985. 4 Fig, 13 Ref.

Descriptors: *Infiltration, *Ponding, *Mathematical equations, Water depth, Numerical analysis, Soil water, Differential equations, Mathematical studies.

Under ponded infiltration the cumulative infiltration is a function of soil properties, initial conditions, and water layer thickness above the soil surface. A simple analytical infiltration formula predicted the cumulative infiltration as a function of time when the soil surface is ponded. For arbitrary soil properties and arbitrary dependence of water layer thickness on time but uniform initial water content, the optimization technique predicts the cumulative infiltration from the integration of an ordinary differential equation. If the thickness of the water layer is constant with time, integration of the differential equation yields a fully analytical result. When the water layer thickness is small, the infiltration rate is significantly different from the standard Green and Ampt result; as the layer thickness increases, the Green and Ampt result becomes increasingly accurate. Comparison with a laboratory infiltration experiment illustrated the validity of the present infiltration expressions. (Collier-IVI)
W86-00049

SOIL WATER EVAPORATION SUPPRESSION BY SAND MULCHES,
Iowa State Univ., Ames. Dept. of Agronomy.
A. S. Modaihsh, R. Horton, and D. Kirkham.
Soil Science, Vol. 139, No. 4, p 357-361, April, 1985. 4 Fig, 11 Ref.

Descriptors: *Soil water, *Evaporation, *Mulches, *Sand mulch, Mulching, Evapotranspiration control, Crop production.

Experiments were performed to study sand as a soil mulch with the objective of determining the comparative effectiveness of 0-, 2-, and 6-cm-thick covering sand layers in suppressing evaporation from columns of soil. Measurements were made by using potential evaporation rates of 1.1 and 0.55 cm/d. In addition to evaporation, soil water distribution with depth was measured for the different sand-cover treatments. Five treatments were studied: check (no sand mulch), 6 cm of coarse sand (C6), 6 cm of fine sand (F6), 2 cm of coarse sand (C2), and 2 cm of fine sand (F2). After 35 d of experiment, the cumulative evaporations for the check, C6, F6, C2, and F2 treatments were measured as 6.79, 1.50, 1.55, 3.76, and 4.62 cm of water, respectively, at a potential evaporation of 1.1 cm/d and, for the potential evaporation of 0.55 cm/d, was correspondingly 6.68, 0.95, 1.21, 2.71, and 4.28 cm. These sets of numbers show that there was marked evaporation reduction for the sand mulches with respect to bare soil (check). The 6-cm sand mulches were the most effective evaporation suppressors. For equal mulch thickness, coarse sand was only slightly more effective than fine sand. Results from soil water distributions with depth for the various treatments also indicated that

the sand mulches were effective in conserving soil water against evaporation losses. The mulches were effective in this order: C6 > F6 > C2 > F2. (Author's abstract)
W86-00050

NUMERICAL CALCULATION OF SATURATED-UNSATURATED INFILTRATION IN A CRACKED SOIL,
Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics.
M. R. Davidson.
Water Resources Research, Vol. 21, No. 5, p 709-714, May, 1985. 6 Fig, 14 Ref.

Descriptors: *Infiltration, *Soil water, Saturated flow, Unsaturated flow, Rainfall, Runoff, Mathematical equations, Wetting.

Infiltration in a nonswelling homogeneous soil containing regularly spaced, water filled, vertical cracks is calculated from a finite difference solution of the saturated-unsaturated flow equations. The numerical scheme is implicit with iteration based on the linear method of successive overrelaxation and uses a correction technique to prevent the accumulation of small iteration errors with time. Results agree well with those derived from a Green-Ampt model. Differences in cumulative infiltration and infiltration rates, expressed as percentages of the corresponding finite difference solution, are usually no more than about 4% and can be much less. Calculations predict that when the magnitude of the moisture potential at the wetting front in low, the persistence of mushrooming of wetted tongues moving out of adjacent cracks results in the formation of an unwetted pocket centered on the line of symmetry when the crack spacing depth ratio is also small. As the pocket fills the infiltration rate exhibits a sudden drop caused by a corresponding rapid fall in lateral potential gradients. As moisture potential at the wetting front becomes more negative, the depth of penetration by the zone of positive presssure decreases, although penetration by the wetting front increases. (Baker-IVI)
W86-00078

EVALUATION OF HYDROLOGIC PROCESSES AFFECTING SOIL MOVEMENT IN THE HAGERMAN FAUNA AREA, HAGERMAN, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4137, 1984. 17 p, 4 Fig, 1 Tab, 2 Ref.

Descriptors: Soil stability, *Erosion, *Perched ground water, Springs, *Agricultural runoff, *Seepage loss, Erosion control, *Idaho, Hagerman fossil beds.

The Hagerman fauna area on the western slope of the Snake River canyon in south-central Idaho is one of the most important locations of upper Pliocene fossils in the world. The fossil beds are distributed vertically through a 500-foot stratigraphic section of the Glenns Ferry Formation. Accelerated soil movement caused by surface-water runoff from irrigated farmlands on the plateau above the canyon and discharge from springs and seeps along the slope of the canyon is eroding the fossil beds. Source of the springs and seeps is a perched aquifer, which is probably recharged by seepage losses from two irrigation canals that head near the canyon rim. Annual canal losses are about 1,900 acre-feet. Annual discharge from springs and seeps is about 420 acre-feet. Corrective measures that could be taken to stabilize the soil movement and preserve the fauna area include: (1) Lining or treating the canals, (2) eliminating the practice of flushing irrigation systems, (3) constructing road berms and cross dips, and (4) establishing an uncultivated strip of land between irrigated farmlands and the canyon rim. (USGS)
W86-00119

USER'S GUIDE FOR A PLANE AND AXISYMMETRIC FINITE ELEMENT PROGRAM FOR STEADY-STATE SEEPAGE PROBLEMS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Automatic Data Processing Center.
F. T. Tracy.
Instruction Report K-83-4, September 1983. Final Report. 58 p, 21 Fig, 1 Append.

Descriptors: *Seepage, *Computer programs, *Mathematical models, Finite element method, Laminar flows, Laplace equation, Darcy's Law, Soil water movement, Groundwater movement.

This report is a user's guide for a plane and axisymmetric finite element method (FEM) computer program for solving steady-state seepage problems. Confined or unconfined, homogeneous or nonhomogeneous, and isotropic or anisotropic problems can be solved. Laplace's Equation and Darcy's Law, the equations governing laminar flow through porous media, are the basis for the analysis. Input to the program consists basically of permeability data, node data, and element data. Output from the program consists of heads at the nodes, discharge velocities at the element centers, and a postprocessor file. For unconfined problems, a description of the resulting phreatic surface is also given. The report also contains some sample problems and a brief description of the theory. (Author)
W86-00156

SEEPAGE ANALYSIS USING THE BOUNDARY ELEMENT METHOD,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
A. K. Chugh, and H. T. Falvey.
REC-ERC-83-11, May 1984. 55 p, 15 Fig, 3 Tab, 18 Ref, Append.

Descriptors: *Groundwater movement, *Seepage, *Soil water movement, *Infiltration, Computer models, Model studies, *Mathematical models, Steady flow, Dams, Foundations, Boundary conditions, Boundary element method, Anisotropy.

A simple and effective extension of the boundary element method for solving basic equation of steady flow in isotropic soil is presented to solve steady confined or steady unconfined flow problems or both in zoned anisotrophic mediums. A computer program listing in FORTRAN IV and a set of user's instructions are included to facilitate the use of the computer program. Only steady-state seepage problems in two-dimensional domains with general distribution of piecewise homogeneous material zones are considered. Sample problems illustrating the use of the computer program and the accuracy of results are given. (Author)
W86-00228

2H. Lakes

SEASONAL SUCCESSION OF PHYTOPLANKTON IN LAKE CONSTANCE,
Konstanz Univ. (Germany, F.R.). Limnological Inst.
U. Sommer.
BioScience, Vol. 35, No. 6, p 351-357, June, 1985. 3 Fig, 49 Ref.

Descriptors: *Seasonal variation, *Succession, *Phytoplankton, *Lake Constance, *Austria, *Switzerland, *West Germany, Stratification, Physicochemical properties, Species composition, Mixing, Destratification.

Phytoplankton succession, the physical and chemical environment, photosynthesis, zooplankton production and population dynamics, bacterio-plankton, and algal sedimentation were studied between 1979 and 1982 on Lake Constance (West Germany, Austria, and Switzerland) and phytoplankton nutrient competition was studied in steady-state and pulsed-state systems. The results of these studies were reviewed in an analysis of the relative importance of temperature, stratification, light, competition for resources, sedimentation, and losses to heterotrophic compartments of the trophic chain in controlling seasonal shifts in phytoplankton species composition and how the importance of those factors varies during the year. In Lake Constance the phytoplankton growth season starts when stratification begins in spring. The seasonal pattern of stratification and mixing is the master environmental variable in deep lakes like Lake Constance. Temperature and sedimentation turn out to be less important in succession than traditionally assumed. Initially, maximum growth rates are favored; later as the water column stabilizes, zooplankton grazing and competition for nutrients become the dominant selective forces. When the mixing depth increases in autumn, algae that can tolerate low light are selected for. During the mixing period in winter, significant algal growth is impossible, the organisms become scarce, most nutrients remain unconsumed in solution, the water becomes highly transparent, and grazing and competition play no role. Shifts in species composition are caused by long-term, regular losses of water column stability such as the autumn increase in mixing depth. (Collier-IVI)
W86-00051

GROUNDWATER SEEPAGE NUTRIENT LOADING IN A FLORIDA LAKE,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Sciences and Engineering.
T. V. Belanger, D. F. Mikutel, and P. A. Churchill.
Water Research, Vol. 19, No. 6, p 773-781, 1985. 3 Fig, 9 Tab, 20 Ref.

Descriptors: *Groundwater movement, *Nutrient loading, *East Lake Tohopekaliga, *Florida, *Seepage, Lakes, Water quality, Piezometers, Seepage meters, Hydrologic budget.

Twenty-five seepage meters were positioned in East Lake Tohopekaliga, Florida, to determine groundwater seepage contributions of water and nutrients to the lake in 1983. Seepage was found to be an important source of water to the lake, contributing 14.3% of the water sources, and rate decreased significantly ($P < 0.01$) with distance from shore. A comparison of the piezometer and seepage meter techniques for measuring nutrient loading to the lake indicates the direct seepage meter technique overestimated nutrient inputs due to the enclosure to the sediments, possibly resulting in anaerobic conditions and increased release rates of ammonium nitrogen and phosphate. These results suggest that past studies employing the technique may be in error. Nutrient loading, calculated from piezometer nutrient data and seepage meter flow data, show that the groundwater nutrient loading in the lake was significant, contributing 8.7 and 17.6% of the total phosphorus and total nitrogen inputs to the lake, respectively. (Author abstract)
W86-00065

UNIFIED THEORY FOR MICROBIAL GROWTH UNDER MULTIPLE NUTRIENT LIMITATION,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
C. Y. Chen, and E. R. Christensen.
Water Research, Vol. 19, No. 6, p 791-798, 1985. 2 Fig, 2 Tab, 17 Ref. U.S. NSF grant CEE 810365

Descriptors: *Microbial growth models, *Limiting nutrients, *Model studies, Threshold models, Product models, Growth kinetics, Growth rates.

A unified theory for microbial growth under multiple nutrient limitation is presented. The theory has a probabilistic foundation and gives the well-known threshold and product models as special cases. The threshold model is obtained for full correlation of cell division activation levels which would occur for a single species from a single clone, growing synchronously. In contrast, the product model applies to zero correlation of the activation levels which is likely to be found in mixed culture. The growth kinetics for each limiting nutrient acting separately, while others are saturation, can be any of the well-known type

e.g. Monod or exponential, or the more general logit (Moser) and Weibull models. The Weibull model is given a novel probabilistic basis. (Author's abstract)
W86-00067

NITROGEN AND PHOSPHORUS SPECIATION AND FLUX IN A LARGE FLORIDA RIVER WETLAND SYSTEM,
Geological Survey, Tallahassee, FL.
J. F. Elder.
Water Resources Research Vol.21, No. 5, p 724-732, May, 1985. 7 Fig, 4 Tab, 51 Ref.

Descriptors: *Wetlands, *Florida, *Apalachicola River, *Nitrogen, *Phosphorus, Nutrients, Suspended sediments, Chemical speciation, Dissolved solids, Nitrates, Particulate matter, Organic compounds.

Nutrient flux was examined in a river wetland system in northern Florida, the Apalachicola River system. The nutrient species differed substantially in the amount of net import or export from the Apalachicola River wetland system. The changes in TN and NO3-N were within the expected error of estimate, and therefore the system cannot be considered either a source or a sink for total or nitrate nitrogen. Significant net changes did occur for other nitrogen species. The system showed a distinct tendency to yield organic nitrogen, both dissolved and particulate, while consuming ammonia nitrogen. These counterbalancing processes are masked by investigation of total nitrogen alone. The flux of ammonia nitrogen was notably different from other species. The behavior of phosphorus was similar to that of nitrogen. Soluble reactive phosphorus decreased, indicating consumption within the system, whereas the remaining dissolved phosphorus showed a net yield. There appeared to be a net yield of particulate and total phosphorus, but the percent changes were barely above errors of estimate. The soluble reactive phosphorus (SRP) budget was similar to that of NH4-N. Import within the system was evident, and the loads at the headwaters and mouth of the river were nearly equal. Input by precipitation was also a significant source of SRP, approaching 10% of the total outflow. For all nitrogen and phosphorus species the predominant source was inflow from the upper watershed near Chattahoochee. The Chipola River was the second major contributor for most species. Groundwater, precipitation, and surface water runoff contributed only a small portion of the total riverine nutrient load. The relative errors of estimate of these components are larger than those of the riverine components, but the overall budget is not appreciably affected by error factors associated with small components. (Baker-IVI)
W86-00080

HISTORICAL CHANGES TO LAKE WASHINGTON AND ROUTE OF THE LAKE WASHINGTON SHIP CANAL, KING COUNTY, WASHINGTON,
Geological Survey, Seattle, WA. Water Resources Div.
M. J. Chrzastowski.
USGS Water-Resources Investigation Report 81-1182, 1983. 39 p, 6 Fig, 1 Tab, 41 Ref.

Descriptors: *Historical shoreline, *Shorelines, *Wetlands, *Shoreline changes, *Canals, Stream loss, Landfill, Land-use planning, Stream diversions, Lakes, Lake hydrology, Maps, *Washington, Seattle, *Lake Washington, Lake Washington Ship Canal, Lake Union, Salmon Bay, Sammamish River, Cedar River, Black River, Duwamish River, Renton, Ballard, Hiram M. Chittenden Locks, Shilshole Bay.

Historical shoreline changes to hydrologic characteristics were studied for Lake Washington and the route of Lake Washington Ship Canal. The study is based on comparison of maps made during the period 1875-1907 and modern topographic maps, supplemented with historical documents that describe the once-natural setting of the lakes and streams in the Lake Washington drainage basin. The observed shoreline changes range from minor to substantial. The water-surface area has been historically reduced by about 6 square kilometers, and total shoreline has been reduced by 20 kilometers. Approximately 4 square kilometers of the historical wetland area has been eliminated, or about 93 percent of the natural wetland extent. The changes have resulted from construction of the Lake Washington Ship Canal and accompanying water-level adjustments, shoreline modification from urban growth of the area, and limited natural processes. The map comparison documents (1) extent of shoreline changes (2) historical loss of wetlands area, (3) loss of small streams that historically entered the lakes and bays, and (4) historical vegetation and land-use patterns around the lakeshore and canal route. The identification of historical shorelines, wetlands, and small streams that have no expression on today's landscape is information of value to land-use planning and local engineering activities. (USGS)
W86-00105

PRELIMINARY EVALUATION OF LAKE SUSCEPTIBILITY TO WATER-QUALITY DEGRADATION BY RECREATIONAL USE, ALPINE LAKES WILDERNESS AREA, WASHINGTON,
Geological Survey, Seattle, WA. Water Resources Div.
For primary bibliographic entry see Field 5C.
W86-00114

COEFFICIENTS FOR USE IN THE U.S. ARMY CORPS OF ENGINEERS RESERVOIR MODEL, CE-QUAL-R1,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5B.
W86-00153

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM PLANTS: SELECTED LIFE HISTORY INFORMATION OF ANIMAL SPECIES ON LAKE CONWAY, FL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 4A.
W86-00197

VOLUNTEER LAKE MONITORING, 1981,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
For primary bibliographic entry see Field 5C.
W86-00200

PHYTOPLANKTON-ENVIRONMENTAL INTERACTIONS IN RESERVOIRS, VOLUME II: DISCUSSION OF WORKSHOP PAPERS AND OPEN LITERATURE,
Tetra Tech, Inc., Bellevue, WA.
M. W. Lorenzen, D. B. Porcella, and T. M. Grieb.
Technical Report E-81-13, September 1981. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 104 p, 3 Fig, 10 Tab, 101 Ref. Contract/Grant No. DACW39-78-C-0088.

Descriptors: *Lake, *Reservoirs, *Phytoplankton, *Algae, *Environmental effects, *Water quality, Model studies, Mixing, Dissolved oxygen, Oxygen, Aesthetics, Trophic level, Eutrophication, Data collections, Sampling, Numerical analysis, Mathematical models, Simulation analysis, Nutrients, Grazing, Limnology, Fish, Chlorophyll, Temperature effects, Photosynthesis.

This report is a supplement to the Proceedings of the Workshop on Phytoplankton-Environmental Interactions in Reservoirs. It is organized to provide a general perspective and interpretation of the knowledge about phytoplankton behavior in reservoirs and to discuss techniques for reservoir study. Topics included are phytoplankton effects on water quality (mixing, vertical zones, and clarity; dissolved oxygen; aesthetic effects; trophic levels), techniques for reservoir study (data collection, multivariate numerical analysis, loading models, simulation models), and reservoir phytoplankton models, (utility, algal production and loss, transport, temperature, light, nutrients, grazing, typical formulations, growth and death rates, and recommended formulations).
W86-00206

LOCATIONS AND AREAS OF PONDS AND CAROLINA BAYS AT THE SAVANNAH RIVER PLANT,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
J. D. Shields, N. D. Woody, A. S. Dicks, G. J. Hollod, and J. Schalles.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82015381. DP-1525 (Rev. 1), May 1982. 19 p, 7 Fig, 2 Tab, 4 Ref. Contract/Grant No. DE-AC09-76SR00011.

Descriptors: *Lakes, *Ponds, *Carolina bays, Shallow water, Savannah River Plant, South Carolina.

The U.S. Department of Energy's Savannah River Plant, a 192,000-acre site in South Carolina, contains 28 ponds and 190 Carolina bays. Carolina bays are defined as elliptical depressions, usually oriented northwest-southeast, with no apparent inlet or outlet. Pat Pond, the largest pond, is 2500 acres. The mean pond area, not including Par, is 17.6 acres (range, 0.4-202.8 acres). The mean area for Carolina bays is 6.6 acres (range, 0.3-124.0 acres). Not all Carolina bays hold water; however, higher soil moisture than the surrounding land is often indicated by aquatic vegetation.
W86-00263

PONDS AND LAGOONS OF HORN AND PETIT BOIS ISLANDS, MISSISSIPPI, GULF ISLANDS NATIONAL SEASHORE: THEIR PHYSICAL SIZE, LITERATURE REVIEW AND RECOMMENDATIONS FOR FUTURE RESEARCH,
National Space Technology Labs., NSTL Station, MS.
S. Shabica, and J. Watkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-137067. National Park Service, Research/Resources Management Report SER-60, January 1982. 29 p, 3 Fig, 8 Tab, 12 Ref.

Descriptors: *Ponds, *Lagoons, *Aquatic life, Oysters, Fish, Horn Island, Petit Bois Island, Gulf Islands National Seashore, Vegetation, Brackish water, Tide lands, Mississippi.

The physical size of bodies of water on Petit Bois Island and Horn Island, Mississippi, was surveyed. Petit Bois Island contains 17 ponds and lagoons (0.17 to 18.04 hectares each) covering a total of 46.26 acres, 3.2% of the island's area. Horn Island has 63 ponds and lagoons (0.08 to 53.63 hectares each) covering a total of 191.58 acres, 5.8% of the island's area. These ponds and lagoons, all brackish, are concentrated on the eastern, geologically oldest, most stable portions of the islands. Since a 1965-1966 survey, 17 ponds on Horn Island have remained relatively stable, 12 water bodies have evolved into 5 discrete ponds, 19 water bodies ceased to exist, and 38 new water bodies have evolved into ponds. The literature on vegetation, fish, and oysters is reviewed. Recommendations for future research are made. Several of these concern aquatic life, particularly fish and oysters.
W86-00278

WAVE DATA ACQUISITION AND HINDCAST FOR SAGINAW BAY, MICHIGAN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
A. W. Garcia, and R. E. Jenssen.
Technical Report HL-83-14, June 1983. Final Report. 69 p, 31 Fig, 4 Tab, 26 Ref, 2 Append.

Descriptors: *Lakes, *Waves, *Data acquisition, Saginaw Bay, Michigan, Storms, Wave height, Model studies, Hindcast models, Wind, Lake Huron, Damage, Adsorption, Shallow water.

A wave-measurement system was deployed in Saginaw Bay, Michigan, for the purpose of determining the wave growth within the bay as functions of fetch and time. The wave data acquired provide the basis for development and verification of a shallow-water wave hindcast model. The hindcast model, along with 20 years of wind data, is used to perform and extremal analysis of wave conditions within Saginaw Bay. Results of the analysis show that a maximum significant wave height of about 8 ft is expected at the head of the bay. (Author)
W86-00282

2I. Water In Plants

INTERCEPTION STORAGE CAPACITIES OF TROPICAL RAINFOREST CANOPY TREES,
Boston Coll., Chestnut Hill, MA. Dept. of Geology and Geophysics.
S. R. Herwitz.
Journal of Hydrology, Vol. 77, p 237-252, 1985. 4 Fig, 2 Tab, 27 Ref.

Descriptors: *Interception storage, *Canopy, *Rain forests, *Trees, *Throughfall, Rainwater, Bark, Vegetation, Leaves.

The rainwater interception storage capacities of mature canopy trees in a tropical rainforest site in northeast Queensland, Australia, were approximated using a combination of field and laboratory measurements. The above-ground vegetative surfaces of five selected species (three flaky-barked; two smooth-barked) were saturated under laboratory conditions in order to establish their maximum interception storage capacities. Average leaf surface interception storages ranged from 112 to 161 ml/sq m. The interception storages of bark ranged from 0.51 to 0.97 ml/cu cm. These standardized interception storages were applied to estimates of leaf surface area and bark volume for 51 mature canopy trees representing the selected species in the field site. The average whole tree interception storage capacities of the five species ranged from 110 to 5281 per tree and 2.2 to 8.3 mm per unit projected crown area. The highly significant interspecific differences in interception storage capacity suggest that both floristic and demographic data are needed in order to accurately calculate a forest-wide interception storage capacity for species-rich tropical rainforest vegetation. Species with large woody surface areas and small projected crown areas are capable of storing the greatest depth equivalents of rainwater under heavy rainfall conditions. In the case of both the flaky-barked and the smooth-barked species, bark accounted for $>$ 50% of the total interception storage capacity under still-air conditions, and $>$ 80% under turbulent air conditions. The emphasis in past interception studies on the role of leaf surfaces in determining the interception storage capacity of a vegetative cover must be modified for tropical rainforests to include the storage capacity provided by the bark tissue on canopy trees. (Author's abstract)
W86-00037

IMPACT OF WATER LEVEL CHANGES ON WOODY RIPARIAN AND WETLAND COMMUNITIES; VOLUME X: INDEX AND ADDENDUM TO VOLUMES I-VIII,
Washington Univ., Seattle. Coll. of Forest Resources.
R. J. Chapman, and T. M. Hinckley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-128132. FWS/OBS-82/23, July 1982. Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team. 110 p, 20 Fig, 6 Tab, 234 Ref, 2 Append. Contract/Grant No. 14-16-0009-953.

Descriptors: *Soil-water-plant relationships, *Vegetation, *Wetlands, *Plant populations, *Water level fluctuations, Ecosystems, Riparian vegetation, Trees, Shrubs, Streams, Flooding, Environmental effects, Aquatic plants, Rivers, Water stress, Drought resistance.

This report provides the user with a summary and a general reference document for Volumes I-VIII of the Fish and Wildlife Service series on Impact of Water Level Changes on Woody Riparian and Wetland Communities. This series reviews and synthesizes existing information on the effects of water level changes on woody plants found in riparian and wetland communities. Such vegetation provides an essential component of habitat for many species of fish and wildlife throughout the United States. This index provides the reader with a summary of the earlier volumes, a list of new literature, excerpts of pertinent recent findings, and a list of errors in preceding volumes. In addition, a section on site rehabilitation has been included. (Author)
W86-00254

IMPACT OF WATER LEVEL CHANGES ON WOODY RIPARIAN AND WETLAND COMMUNITIES; VOLUME IX: THE ALASKA REGION,
Washington Univ., Seattle. Coll. of Forest Resources.
L. C. Lee, and T. M. Hinckley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-128702. FWS/OBS-82-22, July 1982. Fish and Wildlife Services, Kearneysville, WV. Eastern Energy and Land Use Team. 213 p, 28 Fig, 27 Tab, 156 Ref, Append. Contract/Grant No. 14-16-0009-953.

Descriptors: *Soil-water-plant relationships, *Vegetation, *Wetlands, *Plant populations, *Water level fluctuations, Ecosystems, Riparian vegetation, Trees, Shrubs, Streams, Flooding, Environmental effects, Literature review, Cold regions, Tundra, Bogs, Marshes, Swamps, Aquatic plants, Permafrost, Muskeg, Fens, Arctic, Rivers, Water stress.

Literature on wetland and riparian plant communities in Alaska is reviewed for the purposes of planning and land management. Woody plants, perennial graminoids, and many herbaceous species are included. Detailed species lists are provided for three primary divisions (tundra, subarctic, and marine) and six provinces (Arctic tundra, Brooks Range, Bering tundra, Alaska range, Yukon forest, Pacific forest). A section on species tolerance to inundation is provided. Guidelines pertaining to other ecoregions of the U.S. are not applicable to the Alaska region because of unique conditions of cold temperature, high dissolved oxygen concentrations, low plant demand for oxygen, and nitrogen-deficient soils. The appendix lists all the plants believed to occur in Alaskan wetlands.
W86-00292

2J. Erosion and Sedimentation

TRANSPORT OF SUSPENDED MATERIAL IN OPEN AND SUBMERGED STREAMS,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
R. Wiuff.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 774-792, May, 1985. 10 Fig, 1 Tab, 20 Ref, 1 Append.

Descriptors: *Suspended sediments, *Sediment transport, *Mathematical studies, Turbidity currents, Wind-driven currents, Efficiency concept, Energy dissipation.

One of the most useful methods used to establish sediment transport equations is based on the hypothesis that the rate of sediment transport is related to the energy dissipation of the flow. The energy exchange in streams carrying suspended material was analyzed using an efficiency concept. The efficiency is defined as the ratio between the gain in potential energy of the suspended material and the turbulent dissipation. The efficiency is not constant, but depends linearly on Shields' parameter. The linear relation was used to develop a simple formula, which describes the suspended load as a function of well-known parameters. With the results from open streams an auto-suspension criterion was developed for turbidity currents. This criterion describes the situation when a submerged current carrying suspended material neither deposits nor erodes material. A calculated value of the grain size corresponds well with observed values from the turbidity current in Lake Mead. As no constant efficiency is present in open streams as shown in this study, it seems unlikely that this should be the case in more complicated flows such as for wind-driven currents. Because the linear relation between the efficiency and the Shields' parameter cannot easily be extended to wind-driven suspension in lakes, these kinds of phenomena need more sophisticated methods if a satisfactory description of the suspension processes is to be developed. (Collier-IVI)
W86-00013

SEDIMENT TRANSPORT BY IRRIGATION RETURN FLOWS IN FOUR SMALL DRAINS WITHIN THE DID-18 DRAINAGE OF THE SULPHUR CREEK BASIN, YAKIMA COUNTY, WASHINGTON, APRIL 1979 TO OCTOBER 1981,
Geological Survey, Tacoma, WA. Water Resources Div.
P. R. Boucher.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4167, 1984. 149 p, 8 Fig, 14 Tab, 19 Ref.

Descriptors: *Sediment transport, Sediment yield, Sediment discharge, Suspended sediments, *Irrigation practices, Irrigation-return flow, *Water temperature, Sulphur Creek, Yakima County, *Washington, Best Management Practices, Imhoff Cone readings, Suspended sediment concentrations.

Suspended sediment, water discharges, and water temperatures were monitored in four small drains in the DID-18 basin of the Sulphur Creek basin, a tributary to the Yakima River, Washington. Water outflow, inflow, and miscellaneous sites were also monitored. The information was used to evaluate the effectiveness of management practices in reducing sediment loads in irrigated areas. This study was one of seven Model Implementation Plan projects selected by the U.S. Soil Conservation Service and the U.S. Environmental Protection Agency to demonstrate the effectiveness of institutional and administrative implementation of management plans. Sediment discharges from the four basins could not be correlated with changes in management practices, because Imhoff Cone readings collected for the study showed no statistical differences between the three irrigation seasons. However, one drain acted as a sink for sediment where more lands were sprinkler irrigated; this drain had a smaller proportion of row crops than did the other three drains. (USGS)
W86-00112

EVALUATION OF A HYDROGRAPH SHIFTING METHOD FOR ESTIMATING SUSPENDED-SEDIMENT LOADS IN ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
R. Frost, Jr., and J. Mansue.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4037, 1984. 37 p, 14 Fig, 5 Tab, 5 Ref.

Descriptors: *Suspended sediments, *Suspended load, *Hydrographs, *Transport equations, *Illinois, Sediment transport.

A hydrograph-shifting method for estimating monthly and annual suspended-sediment loads was applied to suspended-sediment records for 12 streams in Illinois. Transport equations for each station were developed and synthetic sediment-discharge hydrographs were then generated by using these transport equations and records of daily streamflow. Hydrographs were shifted to measured values of daily sediment discharge selected to represent weekly, biweekly, and monthly sampling frequencies. Estimates of monthly suspended-sediment load ranged from 16 to 326 percent of measured values. Estimates of annual sus-

pended-sediment loads ranged from 41 to 136 percent of measured values. (The method provides a reasonable means of estimating annual loads for most sites.) An experiment designed to measure the subjectivity of the method showed it to be more dependent on the particular days selected as control points than on the person applying the method. An evaluation of the effect of the length of record used to develop transport equations was not conclusive. Although standard errors of estimate showed no improvement, the comparison of estimated loads with measured loads showed slight improvement when 1 or 2 years of data were added to the data used to develop transport equations. (USGS)
W86-00115

PRELIMINARY APPRAISAL OF SEDIMENT SOURCES AND TRANSPORT IN KINGS BAY AND VICINITY, GEORGIA AND FLORIDA,
Geological Survey, Doraville, GA. Water Resources Div.
J. B. McConnell, D. B. Radtke, T. W. Hale, and G. R. Buell.
USGS Water-Resources Investigation Report 83-4060, 1983. 68 p, 23 Fig, 15 Tab, 32 Ref.

Descriptors: *Suspended sediment, *Sediment transport, *Estuaries, Velocity, Salinity, Temperature, *Georgia, Camden County, Florida, Nassau County.

Water-quality, bottom-material, suspended-sediment, and current-velocity data were collected during November 1981 in Kings Bay and vicinity to provide information on the sources and transport of estuarine sediments. Kings Bay and Cumberland Sound, the site of the Poseidon Submarine Base in southeast Georgia, are experiencing high rates of sediment deposition and accumulation, which are causing serious navigational and operational problems. Velocity, bathymetry, turbidity, and bottom-material data suggest that the area in the vicinity of lower Kings Bay is accumulating deposits of suspended sediment transported from Cumberland Sound on the floodtide and from upper Kings Bay and the tidal marsh drained by Marianna Creek on the ebbtide. Suspended-sediment discharges computed for consecutive 13-hour ebbtides and floodtides showed that a net quantity of suspended sediment was transported seaward from upper Kings Bay and Marianna Creek. A net landward transport of suspended sediment computed at the St. Marys Entrance indicated areas seaward of St. Marys Entrance may be supplying sediment to the shoaling areas of the estuary, including lower Kings Bay. (USGS)
W86-00125

RUNOFF, SEDIMENT TRANSPORT, AND WATER QUALITY IN A NORTHERN ILLINOIS AGRICULTURAL WATERSHED BEFORE URBAN DEVELOPMENT, 1979-81,
Geological Survey, Urbana, IL. Water Resources Div.
H. E. Allen, Jr., and J. R. Gray.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 82-4073, 1984. 55 p, 15 Fig, 11 Tab, 23 Ref.

Descriptors: *Sediment discharge, *Storm runoff, *Rainfall, *Agricultural runoff, Water pollution sources, Sediment transport, *Sediment yield, *Peak discharge (water), Streamflow, *Agricultural watershed, Erosion, Land use, Water quality, Soil surveys, Particle size, Bedload, Water temperature, Specific conductivity, Dissolved solids, Chemical analysis, Gaging stations, *Illinois, *Upper Spring Creek watershed, Rockford (IL), Storm characteristics, Urban construction, Erosion potential, Land cover.

A study designed to quantify and evaluate changes in runoff and sediment transport attributable to construction activities during urban development of a watershed required identification of pre-construction hydrologic conditions. Data collected before construction on a 2.81 sq m (7.28 sq km) agricultural watershed (upper Spring Creek) near Rockford, IL, show that during a 2-year period ending June 30, 1981, 2,890 tons (2,620 Mg) of suspended sediment were transported from the watershed. Of the 2,890 tons (2,620 Mg), 2,690 tons (2,440 Mg) or 93.1 % were transported during a storm in a 46.6-hour period of June 13-14, 1981. Runoff from a 0.031 sq m (0.080 sq km) subbasin (Spring Creek tributary) transported 33.9 tons (30.9 Mg) of suspended sediment during a 3.2-hour storm period on June 13, 1981. Regression models relating storm suspended-sediment yields and peak-water discharge per square mile for upper Spring Creek and Spring Creek tributary have average standard errors of 57 and 24 %, respectively. Trace amounts of currently banned pesticides, including Aldrin and DDT, were detected in streambed material samples. Documented sediment yields, chemical quality, and relations between runoff and sediment discharge provide baseline information for future evaluation of hydrologic conditions in the watershed. (USGS)
W86-00133

SOURCES, COMPOSITION, AND TRANSPORT OF SUSPENDED PARTICULATE MATTER IN LOWER COOK INLET AND NORTHWESTERN SHELIKOF STRAIT, ALASKA,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, and G. J. Massoth.
NOAA Technical Report ERL 415-PMEL 34, January 1982. 28 p, 17 Fig, 2 Tab, 28 Ref.

Descriptors: *Particulate matter, *Chemical analysis, *Seasonal distribution, *Sediment transport, Suspended load, Salinity, Bays, Estuaries, Cook Inlet, Shelikof Strait, *Alaska, Tides, Currents.

The chemical composition and seasonal distribution of suspended particulate matter collected during 1977 and 1978 in lower Cook Inlet and northwestern Shelikof Strait are compared with published data on current patterns. With respect to suspended-matter dispersal patterns, Cook Inlet shows characteristics of both an estuary and an embayment. Estuarine characteristics are exemplified by the association of the inorganic terrestrial material from upper Cook Inlet with the outward-flowing estuarine water. Plots of total suspended-matter concentrations versus salinity for surface and near-bottom waters are roughly linear for the central region of lower Cook Inlet, indicating that dilution of the estuarine water by relatively nonturbid oceanic water is the major factor controlling suspended-matter concentrations in the inlet. Embayment characteristics are indicated by the cross-channel suspended-matter gradients and by the elemental ratios of the particulate matter, which show evidence for movement of Copper River-derived aluminosilicate material across the mouth of the inlet and into Shelikof Strait. These features, which are unique to lower Cook Inlet, are a direct result of the unusual nature of the current patterns existing within the inlet. (Author)
W86-00150

SUSPENDED PARTICULATE MATTER IN ELLIOTT BAY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
E. T. Baker.
NOAA Technical Report ERL 417-PMEL 35, March 1982. 44 p, 34 Fig, 7 Tab, 17 Ref.

Descriptors: *Particulate matter, Suspended load, *Suspended solids, *Suspended sediment, Distribution, Sediment transport, Elliott Bay, Puget Sound, Bays, *Washington.

The distribution and transport of suspended particulate matter (SPM) in Elliott Bay, an embayment of Puget Sound, Washington, was compared for dry (August) and wet (February) seasons of 1979-1980. During both survey times, the SPM distribution throughout the bay consisted of 1) a thin (< 5 m) surface layer of variable SPM concentration dominated by phytoplankton growth in summer and Duwamish River runoff in winter, 2) a uniform mid-depth minimum-SPM zone, and 3) a bottom nepheloid layer of concentrations and thickness highly variable in space and time. The total mass of SPM in Elliott Bay was about 20% higher in February (15.7 to the 8th g) than in August (13.0 to the 8th g). Scatter plots of salinity vs. SPM for both seasons indicate a strong negative correlation (r=-.95) in the surface water and a weaker positive correlation (r=.52) in the bottom waters. Vertical and horizontal transport of SPM was measured with sediment traps and current meter/transmissometer deployed at two stations. Accumulation of settled SPM 5 m above the bottom was 16%-30% higher in summer (approximately 34.5 g/sq m/day) than in winter (26.8 g/sq m/day). Organic matter made up 6.9%-12.3% of the trapped sediment. Cross-spectral analysis between near-bottom velocity and SPM concentration showed significant coherency at tidal frequencies. Transport of the SPM was dominated by the mean flow, and diffusion components had little influence. The high positive correlations between SPM and salinity concentrations and low negative correlations between SPM concentrations and current speed imply that advection plays a larger role than resuspension in maintaining the bottom nepheloid layer in Elliott Bay. (Author)
W86-00151

SEDMNT: A SEDIMENT TRANSPORT SUBMODEL BASED ON HYDRODYNAMIC PRINCIPLES FOR THE UNIFIED TRANSPORT MODEL,
Oak Ridge National Lab., TN. Environmental Sciences Div.
D. M. Hetrick, M. R. Patterson, and A. L. Sjoreen.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82008904. ORNL/TM-7831, March 1982. 121 p. 5 Fig, 2 Tab, 11 Ref, 4 Append. Contract/Grant No. W-7405-eng-26.

Descriptors: *Computer programs, *Sedimentation, *Computer models, *Mathematical models, *Sediment transport, Streams, Channel flow, Erosion, Scour.

SEDMNT is a computer code written to model the movement of sediment through a stream channel, and is based on the SEDONE model. The mathematical model of SEDMNT consists of a system of coupled, ordinary differential equations for sediment concentration (by size class) which are solved by the Runge-Kutta-Gill integration scheme. Sediment of selected size classes is resident in the channel bed and enters the channel with stream flow. Transportation, erosion, or deposition of sediment may occur for each size class depending on the amount of sediment present and the stream volume, velocity, and turbulence. Input to the model includes flow data from the calling program (UTM) and initial sediment concentrations provided by the user. Output includes a listing of the input and calculated sediment concentrations for selected time steps. Thorough testing of SEDMNT within the framework of UTM will not be possible until a complete data set is available. SEDONE, the basis of SEDMNT, has been thoroughly tested with data from the Hudson, Mississippi, and Atchafalaya Rivers. This testing was done by running SEDMNT with a stand-alone driving program rather than within UTM. It is possible that additional adjustment of the empirical parameters in SEDMNT will be needed as better test data becomes available. The results obtained from SEDMNT for the Walker Branch Watershed are encouraging. Past success with the SEDONE model implies that SEDMNT can be used to produce useful information on the possible fate of transported sediment.
W86-00155

BUHNE POINT, HUMBOLDT BAY, CALIFORNIA, DESIGN FOR THE PREVENTION OF SHORELINE EROSION: HYDRAULIC AND NUMERICAL MODEL INVESTIGATIONS,
Coastal Engineering Research Center, Vicksburg, MS.
For primary bibliographic entry see Field 4D.
W86-00169

SHORE STABILIZATION WITH SALT MARSH VEGETATION,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8G.
W86-00189

HYDROCARBONS ASSOCIATED WITH SUSPENDED MATTER IN THE GREEN RIVER, WASHINGTON,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5B.
W86-00196

SAND RESOURCES AND GEOLOGICAL CHARACTER OF LONG ISLAND SOUND,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8E.
W86-00205

STREAM CHANNEL STABILITY ASSESSMENT,
Geological Survey, Menlo Park, CA.
J. C. Brice.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-118190. Report No. FHWA/RD-82-021, January 1982. Final Report. Federal Highway Administration, Washington, DC. 42 p, 33 Fig, 2 Tab, 44 Ref. Coontract/Grant No. DTFH61-81-P-30085.

Descriptors: *Erosion, *Streams, *Hydraulic structures, *Bridges, *Channel morphology, Streambanks, Channel scour, Scour, Channel erosion, Alluvial channels, Highways, Roads, Unstable channels, Bank, erosion, Stream erosion, Stream banks, Maps, Aerial photography, Photography, Meanders, Braided streams, Degradation, Thalweg.

A simple method for determining relative stability of streams is based on stream morphology. This is useful for planning highway bridges. Channel instability is manifested as lateral bank erosion, progressive streambed degradation, or natural scour and fill of the streambed. Four major stream types are distinguished, based on variability of width and presence of bars: equiwidth, point bar; wide-bend, point bar; braided, point-bar; and braided, no point bars. Measurements of bank erosion on a group of 36 streams show that equiwidth streams have the lowest lateral erosion rates; braided, point bar streams have the highest. Erosion rates increase with stream size. Lateral stability may be measured by field assessment, repetitive surveys of channel cross section, and measurement on air photos and maps. Methods for assessing channel degradation include field studies, changes in elevation of the water surface or channel bottom and hydraulic analysis. The degree of meandering and degree of channel instability are unrelated. Natural scour and fill occurs by three different mechanisms, all relevant to bridge pier depth: bed form migration, convergence of flow, and shift of thalweg or braids within a channel.
W86-00214

DEVELOPMENT OF A NUMERICAL MODELING CAPABILITY FOR THE COMPUTATION OF UNSTEADY FLOW ON THE OHIO RIVER AND ITS MAJOR TRIBUTARIES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 2E.
W86-00220

EFFECTS OF BEACH NOURISHMENT ON THE NEARSHORE ENVIRONMENT IN LAKE HURON AT LEXINGTON HARBOR (MICHIGAN),
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 6G.
W86-00224

DESIGN FOR PREVENTION OF BEACH EROSION AT PRESQUE ISLE BEACHES, ERIE, PENNSYLVANIA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-00257

MATHEMATICAL MODEL, SERATRA, FOR SEDIMENT-CONTAMINANT TRANSPORT IN RIVERS AND ITS APPLICATION TO PESTICIDE TRANSPORT IN FOUR MILE AND WOLF CREEKS IN IOWA.
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W86-00259

ANSWERS (AREAL NONPOINT SOURCE WATERSHED ENVIRONMENT RESPONSE SIMULATION) USER'S MANUAL.
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W86-00287

2K. Chemical Processes

AVERAGE RAINWATER PH, CONCEPTS OF ATMOSPHERIC ACIDITY, AND BUFFERING IN OPEN SYSTEMS,
Texas Univ. at Austin. Dept. of Environmental Health Engineering.
For primary bibliographic entry see Field 5B.
W86-00001

ANALYSIS AND INTERPRETATION OF DATA OBTAINED IN TESTS OF THE GEOTHERMAL AQUIFER AT KLAMATH FALLS, OREGON,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-00107

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE MOUNT SIMON-HINCKLEY AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
R. J. Wolf, J. R. Ruhl, and D. G. Adolphson.
USGS Water-Resources Investigation Report 83-4031, 1983. 2 p, 14 Fig, 3 Tab, 19 Ref.

Descriptors: *Groundwater, *Water quality, *Aquifers, *Maps, Minnesota, Hollandale embayment, Twin Cities basin.

The Mount Simon-Hinckley aquifer comprises a thick sequence of sandstone, siltstone, and shale that underlies southeast Minnesota. It is an important aquifer in the Hollandale embayment and in the populous Twin Cities metropolitan area, where it supplies about 10 percent of the groundwater used. Withdrawals increase significantly north of the Twin Cities basin, but some additional development of water supplies is still possible. Yields to wells are generally about 500 gallons per minute but may be as much as 2,000 gallons per minute locally. Dissolved-solids concentrations are slightly lower than in water from other aquifers in the Hollandale embayment and range from about 100 milligrams per liter in the north to as much as 2,400 milligrams per liter in the south. Dominant water type is calcium magnesium bicarbonate; however, sodium chloride-type water is found at depth. Water from the aquifer locally contains iron and manganese in concentrations greater than 1 milligram per liter. (USGS)
W86-00109

QUALITY OF WATER, QUILLAYUTE RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
M. O. Fretwell.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4162, 1984. 96 p, 24 Fig, 16 Tab, 35 Ref.

Descriptors: *Water quality, *Groundwater, *Surface water, *Estuaries, Quileute Indian Reservation, Quillayute River, *Washington.

Groundwater in Quillayute River basin is generally of the calcium bicarbonate type, although water from some wells is affected by seawater intrusion and is predominantly of the sodium chloride type. The water is generally of excellent quality for most uses. River-water quality was generally excellent, as evaluated against Washington State water-use and water-quality criteria. Fecal coliform concentrations in all major tributaries met State water-quality criteria; water temperatures occasionally exceeded criteria maximum during periods of warm weather and low streamflow. Nutrient concentrations were generally low to very low. The four largest lakes in the basin were temperature-stratified in summer and one had an algal bloom. The Quillayute estuary had salt-wedge mixing characteristics; pollutants entering the salt wedge tended to spread to the toe of the wedge. Upwelling ocean water was the major cause of the low dissolved-oxygen concentrations observed in the estuary; ammonia concentrations in the estuary, however, were increased by the upwelling ocean waters. As in the rivers, total-coliform bacteria concentrations in the estuary were greater than fecal-coliform concentrations, indicating that many of the bacteria were of nonfecal origin and probably originated from soils. (USGS)
W86-00111

INVESTIGATION OF WAIKELE WELL NO. 2401-01, OAHU, HAWAII: PUMPING TEST, WELL LOGS AND WATER QUALITY,
Geological Survey, Honolulu, HI. Water Resources Div.
P. R. Eyre.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4089, 1983. 38 p, 9 Fig, 5 Tab, 6 Ref.

Descriptors: *Groundwater quality, *Irrigation return flow, *Ghyben-Herzberg groundwater lens, *Aquifer testing, Oahu, *Hawaii, Basalt aquifer.

Field tests indicate that an abandoned well (No. 2401-01) near the confluence of Waikele and Kipapa Streams, Oahu, Hawaii, can be reactivated to produce potable water at a rate of 400-500 gallons per minute. Previous tests in 1946 and 1954 indicated that the well tapped the brackish transition zone which inderlies the Ghyben-Herzberg lens of the Pearl Harbor aquifer. Results of this study, based on geologic and geophysical logs of the wall, as well as on pumping test and water-quality data, indicate that the slightly brackish water produced by the well results from brackish irrigation return water. It does not appear that pumping from this well will cause seawater upconing or intrusion. (USGS)
W86-00118

EFFECTS OF ACID RAIN ON SOIL AND WATER,
Connecticut Agricultural Experiment Station, New Haven.
E. C. Krug, and C. R. Frink.
Bulletin 811, November 1983. 45 p, 6 Fig, 7 Tab, 299 Ref.

Descriptors: *Acid rain, *Acidic water, *Acidic soils, *Chemical properties, *Land use, Organic acids, Air pollution, Forest watersheds, Forest soils, Water pollution, Leaching, Aluminum, Reforestation, Water pollution sources.

The impact of acid rain on soil and water can only be judged by placing it in perspective with the natural processes of soil acidification. Most of the natural acidity of rain is due to H_2CO_3, a weak acid that does not completely dissociate. The acidi-

ty of rain can also be expressed in terms of its ability to neutralize basic substances such as limestone. Man-made inputs are very small when compared with normal agricultural amendments with limestone, or with the tremendous amounts of acidity produced in forest soils on highly siliceous parent material. Acidity in soils is generated by biological decomposition which creates oxides of C, N, and S that react with water to form acids. Because cation exchange reactions are rapid, extra H ions from acid rain could leach nutrient cations from the soil. Despite chemical and biological evidence that acid rain will not enhance leaching of nutrient cations from the acid forest soils of the Northeast, southeastern Canada and Scandinavia, misconceptions about the nature of soil acidity sustain the notion that acid rain is increasing acidification of soil and water. Another misconception is that the rate of acid production in soil is equal to the rate of mineral weathering plus acid export. The largest cause of acidification of lakes and streams is generally the revegetation and reforestation of disturbed land. The degree to which acid rain may be accelerating this process needs to be evaluated on a watershed basis.
W86-00166

DISSOLVED METHANE CONCENTRATIONS IN THE SOUTHEAST BERING SEA, 1980 AND 1981,
Science and Education Administration, Fort Lauderdale, FL. Aquatic Plant Management Lab.
C. N. Katz, J. D. Cline, and K. Kelly-Hansen.
NOAA Data Report ERL PMEL-6, July 1982. 194 p, 4 Ref, 3 Append.

Descriptors: *Methane, *Water Quality, Water chemistry, *Data collections, *Chemical analysis, Salinity, Solubility, *Bering Sea.

Dissolved methane was measured in the southeastern Bering Sea as a part of the Outer Continental Shelf Environment Assessment Program, administered by the National Oceanic and Atmospheric Administration. Methane analysis was routinely done in the field using a purge and trap technique, followed by quantitation on a Hewlett-Packard 5710 A gas chromatograph. The data presented are organized in a hierarchy of cruise (chronological order), station and depth distribution. Station data include: station number, latitude and longitude to the nearest tenth of a degree; local data and time of sampling, Greenwich Mean Time zone, and depth to the bottom in meters. Depth information includes: depth of the sample in meters, water temperature in degrees centigrade, salinity in grams per kilogram, sigma-t, dissolved methane concentration in nanoliters of methane gas per liter seawater corrected to standard temperature and pressure (STP), dissolved methane equilibrium solubility, and the methane solubility ratio (C/C*), which is the ratio of the observed methane concentration to the equilibrium solubility methane concentration.
W86-00180

KARNES COUNTY, TEXAS, AREA HYDROCHEMICAL AND STREAM URANIUM ORIENTATION STUDY,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
K. F. Steele.
National Uranium Resource Evaluation Program, Report No. DPST-81-141-18, April 1982. 14 p, 1 Fig, 6 Tab, 5 Ref. Contract/Grant No. DE-AC09-76SR00001.

Descriptors: *Geochemistry, *Uranium, *Groundwater, *Water analysis, Wells, Mineral industry, Water pollution sources, Fate of pollutants, Karnes County, Texas, Surface water, Sediments, Bed sediments, Suspended sediments.

Groundwater sampling may be an effective method of sampling for uranium deposits in South Texas. Stream and groundwater samples were collected over and near known uranium deposits. The stream water quality parameters were more constant than the groundwater parameters. For example, pH was 7.5-8.5 in surface water, 6.2-9.1 in groundwater; conductivity was 1100-2300 micromhos/cm in surface water, 54-8900 micromhos/cm in groundwater; uranium, < 4 to 25 parts per billion in surface water, about 2 parts per million in stream sediment, and < 4 to 66 parts per billion in groundwater. Samples with high uranium levels were collected in wells penetrating known ore zones. Sulfate levels were also high in high-uranium samples.
W86-00194

2L. Estuaries

TRACER APPLICATIONS OF ULTRA-VIOLET ABSORPTION MEASUREMENTS IN COASTAL WATERS,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
P. Foster.
Water Research, Vol. 19, No. 6, p 701-706, 1985. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Environmental tracers, *Ultraviolet absorption, *Coastal waters, *Absorption, Radiation, Tracers, Organic compounds, Inorganic compounds, Nitrates, Bromides.

The ultra-violet absorption properties of natural waters may be used as a tracer for following the distribution of source waters in coastal water systems. Measurements can be made readily upon sample collection and filtration on board ship. The form of the spectrum can be considered as two distinct sections: within the spectral region 250-350 nm modifications of the UV absorption are direct manifestations of changes in the concentration and/or nature of the dissolved organic matter; below 250 nm inorganic species, such as nitrate and bromide, in addition to the dissolved organic matter, contribute to the absorption. UV data was collected during two winter cruises off the west coast of Great Britain. Four absorption indices were developed as being of potential tracer value to mixing studies in coastal waters. The intensity factor in the organic region of the spectrum was numerically evaluated as the integrated absorption (Sigma A) between 250 and 350 nm, while the magnitude of the absorption at 225 nm (A225) was adopted as the intensity factor for the composite region. The organic and composite shape factors were evaluated as the absorption ratios, A250/A275 and A225/A250, respectively. In March salinity was highly correlated with Sigma A. Offshore waters were characterized by high salinities and low values of Sigma A. Coastal waters of low salinity and high Sigma A formed the other end member and in contrast to the analogous mixing diagram for December there was no clear distinction between bay and coastal waters with respect to their Sigma A loading. The relationship which best met the tracer criterion of a low correlation coefficient was that between salinity and the intensity factor A225; this relationship provided a very effective separation of three water types. A marked temporal change in the absorption characteristics was associated the waters in particular areas. As a consequence, the most effective combination of tracer indices at one time of year may not necessarily be the most effective combination at another. (Collier-IVI)
W86-00056

EFFECTS OF SPATIAL VARIATION IN AMPLITUDE AND PHASE OF THE OSCILLATORY TIDAL CURRENTS ON THE RESIDUAL LAGRANGIAN DRIFTS,
Delaware Univ., Newark. Coll. of Marine Studies.
K.-C. Wong.
Water Resources Research, Vol. 21, No. 5, p 769-774, May, 1985. 6 Fig, 5 Ref.

Descriptors: *Tidal currents, *Estuarine environment, *Lagrangian circulation, Circulation, Water currents, Tidal waters, Spatial distribution, Velocity.

The understanding of the characteristics of residual Lagrangian circulation in estuaries is important, since the transport of dissolved or suspended material is a Lagrangian phenomenon. The basic behaviors of residual Lagrangian drifts under the influence of oscillatory tidal currents with spatial variations in amplitude and phase are examined analytically for relatively simple Eulerian velocity fields. Intense residual Lagrangian drifts are generated by strong spatial velocity gradients and the residual drifts at any given location are heavily dependent on the initial release time relative to the phase of the tidal current. A relatively weak mean flow can interact with the tidal currents and produce significant modification of the residual drifts as well as their dependency on the initial conditions. Both the magnitude and the direction of the mean flow are important in affecting the dependency of the residual drift estimates on the initial conditions. The presence of strong spatial variation in tidal current may render the approximation of some equations invalid so estimation of residual Lagrangian drifts based on limited Eulerian measurements will lead to large errors under these circumstances. Strong spatial gradients in tidal currents are able to induce intense residual Lagrangian drifts and these residual drifts depend strongly on the release time relative to the phase for the tidal currents. Given a tidal current field with strong spatial gradients, a relatively weak mean flow can modify the residual drifts as well as their dependency on the initial conditions significantly. The mean flow direction is very important to the residual drift estimates. (Baker-IVI)
W86-00085

CIRCULATION IN THE LOWER COOK INLET, ALASKA,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. D. Muench, J. D. Schumacher, and C. A. Pearson.
NOAA Technical Memorandum ERL PMEL-28, July 1981. 26 p, 10 Fig, 2 Tab, 32 Ref.

Descriptors: *Water currents, *Tidal currents, *Flow rates, Ocean currents, Flow pattern, Flow, Cook Inlet, Shelikof Strait.

Circulation in the lower Cook Inlet region has been described and discussed utilizing current observations obtained during October 1977-October 1978. The major circulation feature was a mean westerly flow which entered the region via Kennedy and Stevenson entrances, parallels the 100-m isobath through the lower Inlet, then exits the system via Shelikof Strait. Summer mean current speeds in this flow were 10-15 cm/s. Winter speeds were 25-30 cm/s. A secondary circulation feature was present as a southward flow which occupied the western portion of the lower Inlet. Summer current speeds here were 15-20 cm/s, while winter speeds were of order 10 cm/s. The westerly flow is driven in summer primarily by a baroclinic field consequent to coastal freshwater input (the Kenai Current), while in winter this flow is driven to a greater extent by wind-driven coastal convergence and possibly by an alongshore pressure gradient set up by the Alaskan Stream. The southward flow, driven by freshwater input into upper Cook Inlet, therefore is larger in summer when this input is greater. Mean flow in the eastern lower Inlet was weak and variable in all seasons. Low-frequency and tidal flow fluctuations were superimposed upon the mean flow, and in regions of low mean speeds, controlled the instantaneous flow. The low-frequency fluctuations were associated with westerly flow through the system. Tidal currents were large (70-100 cm/s) and primarily semidiurnal in the eastern portion of the the lower Inlet and in the Kennedy and Stevenson entrances. In the western Inlet, tidal currents were only half this magnitude, and in Shelikof Strait they were very small due to the presence of an antinode near the mooring in northern Shelikof Strait. Tidal currents were aligned with the local channel bathymetry. (Author)
W86-00149

SOURCES, COMPOSITION, AND TRANSPORT OF SUSPENDED PARTICULATE MATTER IN LOWER COOK INLET AND NORTHWESTERN SHELIKOF STRAIT, ALASKA,

LIBRARY OF THE UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2J.
W86-00150

SUSPENDED PARTICULATE MATTER IN ELLIOTT BAY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2J.
W86-00151

ATCHAFALAYA RIVER DELTA; REPORT 9: WIND CLIMATOLOGY,
Coastal Engineering Research Center, Vicksburg, MS.
B. A. Ebersole.
Technical Report HL-82-15, January 1985. Report 9 of a Series. 122 p, 57 Fig, 44 Tab, 6 Ref.

Descriptors: *Climatology, *Hydrodynamics, *Wind, *Weather patterns, *Bays, Wind velocity, Meteorological data collection, Seasonal variation, Model studies, Statistical analysis, Weather data collections.

Data on the wind climate typical of the Atchafalaya Bay area were gathered from October 1981 to October 1982. These data along with data from National Weather Service stations were statistically analyzed to give estimates of wind speed and direction. These statistics were then related to the different kinds of weather patterns that affect this region by categorizing these patterns into seven all-inclusive types with each defined by a particular set of dynamical characteristics. Data was provided on the frequency of occurrence of wind conditions both with and without regard to their causative factors. The latter results were used to substantiate results obtained using the statistical-climatological approach. The long-term historical data gave information on extreme wind conditions that can be expected to occur in any given year. This data can be used to better understand physical processes within the bay that are strongly dependent on local wind conditions such as hydrodynamic circulation patterns, flooding and drying of marshes, dispersion and disposition of sediments, dispersion of any pollutants, and distribution of fresh and salt water.
W86-00163

CURRENT MEASUREMENTS IN THE COLUMBIA RIVER ESTUARY,
Chalmers Univ. of Technology, Goeteborg (Sweden). Institutionen foer Kaernkemi.
M. R. Mulhern.
Master of Science, Report. University of Washington, Seattle. 1982. 60 p, 10 Fig, 2 Tab, 16 Ref, 1 Append.

Descriptors: *Water currents, *Computer programs, Tidal currents, Estuaries, Current meters, Columbia River.

The principal product of this study was the development and analysis of contour plots of mean phase difference and velocity ratios, at the Columbia River entrance. Surface and subsurface currents were monitored by drifter buoys and subsurface current meters respectively in September 1981. Analog plots of the field data were scanned visually, and smoothed to eliminate high-frequency noise. A computer data base was produced containing flow information sorted by current meter depth, and type of event (slack, flood or ebb). A series of computer programs were written to process the data and generate composite views of mean phase difference and velocity ratios, as compared to predicted tidal currents.
W86-00181

NORFOLK HARBOR AND CHANNELS DEEPENING STUDY, REPORT 1: PHYSICAL MODEL RESULTS, CHESAPEAKE BAY HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
D. R. Richards, and M. R. Morton.
Technical Report HL-83-13, June 1983. Final Report. 371 p, 29 Fig, 14 Tab, 236 Plates, 9 Ref.

Descriptors: *Estuaries, *Saline water intrusion, *Channel improvement, *Water currents, *Tidal effects, Shallow water, Salinity currents, Navigation, Model studies, Hydraulic models, Norfolk Harbor, Chesapeake Bay, Tidal currents, Neap tides, Spring tides, Stratification, Harbors.

A physical model was use to study the impact of deepening the approach channels to Norfolk and Newport News, Virginia, in the Chesapeake Bay. Steady-state tests were designed to determine the tide and current velocity effects. The dynamic tests were used to study salinity redistribution. The salinity study showed the following: neap-spring variations (as great as 5-8 ppt) in salinity stratification, an increase in salinity intrusion normally confined to deep water areas (shallow water only slightly affected), redistribution of salt within the cross section of channels with adjacent shallow water (salinity increase in channel and decrease in shallow water), and net increase in depth-averaged salt with an increase in stratification. On the average, changes in salinity were less than 2 ppt.
W86-00266

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

HIGH-TEMPERATURE DESALINATION CAPABILITY OF TFC 1501 REVERSE OSMOSIS ELEMENT,
Army Mobility Equipment Research and Development Command, Fort Belvoir, VA.
H. H. Goto.
Available from the National Technical Information Service, Springfield, VA 22161 as AD1A121059. Report 2367, July 1982. 36 p, 7 Fig, 4 Tab, Append.

Descriptors: *Desalination apparatus, *Reverse osmosis, Membrane processes, Water treatment, Saline water.

The desalination capability of spiral-wound thin-film composite reverse osmosis elements (TFC 1501) was determined at temperatures up to 132 F, higher than the 113 F specified by the manufacturer. The elements were not degraded in desalinizing capability following exposure for 400 hours to feedwater at about 130 F. The production rate of the elements dropped less than 5% under the following conditions: 400 hours at 130 F and 200 hours at 130 F and high pressure (600 lb per sq in). The drop in production rate can be compensated for by operation at higher pressure, 1000 lb per sq in. Some telescoping of the elements occurred during high-temperature operation, but performance characteristics were not degraded.
W86-00265

3B. Water Yield Improvement

RAINWATER CATCHMENT WATER QUALITY IN MICRONESIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
T. A. Dillaha, III, and W. J. Zolan.
Water Research, Vol. 19, No. 6, p 741-746, 1985. 1 Fig, 3 Tab, 18 Ref.

Descriptors: *Rainwater catchment systems, *Domestic water, *Micronesia, *Water quality, Bacteria, Cisterns, Potable water, Water supply, Coliforms.

Rainwater catchment systems (RWCS) in Micronesia were sampled to assess their bacteriological water quality and to determine which RWCS characteristics had a significant impact on water quality. Total and fecal coliform bacteria tests were used to evaluate 203 catchments on 10 islands. Fifty-seven percent of the RWCS had no fecal coliform bacteria and 61% had fewer than 10 total coliform bacteria per 100 ml. Catchment characteristics were found to have a statistically significant effect on total coliform bacteria levels but they did not affect fecal coliform bacteria concentrations. Rainwater catchment systems were found to provide acceptable water in most cases but disinfection prior to consumption is still highly recommended. (Author's abstract)
W86-00061

CLOUD PHYSICS STUDIES IN THE SCPP: INTERIM PROGRESS REPORT, 1983-84.
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
December 29, 1984. 123 p. Contract/Grant No. 2-07-81-V0256.

Descriptors: *Precipitation, *Weather modification, *Cloud seeding, Cloud physics, Orographic precipitation, Sierra Cooperative Pilot Project, Ice.

Several articles report some of the scientific contributions to the Sierra Cooperative Pilot Project. The shallow orographic cloud which remains on the Sierra barrier following passage of upper level hyperbaroclinic zones and katabatic fronts usually contains a substantial amount of supercooled water. The seedability of this cloud will be investigated. In a seeding experiment with dry ice, seeding effects were observed. Combined hydrometeor distributions from three PMS probes were described. In the ice multiplication region centered at -5 degrees C, the combined data are superexponential distributed so that they fit a straight line on a log-log plot. The remaining articles are reprints of referred articles and conference papers.
W86-00305

STRUCTURE OF COLD FRONTS OVER CALIFORNIA,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
J. D. Marwitz.
In: Cloud Physics Studies in the SCPP: Interim Progress Report, 1983-84, December 29, 1984. p 1-28, 8 Fig, 12 Ref.

Descriptors: *Precipitation, *Weather modification, *Cloud seeding, Cloud physics, Katabatic frontal theory, California, Fronts, Sierra Nevadas.

The structure of cold fronts as they move over the Sierra barrier of California are described. The structure of the katabatic front on February 12, 1983, is presented including the kinematic structure as revealed by the serial rawinsondes at Sheridan, California, and the precipitation process as revealed by King Air cloud physics data. These katabatic fronts may represent significant seeding potential.
W86-00306

RESPONSES TO SEEDING CLOUDS WITH DRY ICE IN THE SCPP-1 EXPERIMENT,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
A. R. Rodi.
IN: Cloud Physics Studies in the SCPP: Interim Progress Report, 1983-84, December 29, 1984. p 29-52, 14 Fig, 1 Ref.

Descriptors: *Weather modification, *Precipitation, *Cloud seeding, Orographic precipitation, Cloud physics, Sierra Cooperative Pilot Project, Ice, Dry ice.

Three case studies of treatment of convective clouds were presented. The two cases on March 15, 1984, were probably unseeded. This conclusion is based on the overwhelming body of physical evidence in which no seeding signature was found. The proximity of the seeding to natural echoes (even downwind of them) was not intentional in these cases. The lack of growth of the second cloud was probably the result of the presence of

these large natural cells. The two clouds, studied within the three-hour experiment, were very different in properties as indicated by the response variables presented. The first cloud, while having more initial ice present, persisted longer and had a much larger quantity of precipitation at 18 min than the second cloud. Both clouds, however, were clearly not in the formation region upwind of naturally occurring echoes as prescribed in the design document. The intentional seeding of the large convective cell on February 24, 1984, while producing a microphysical seeding signature, demonstrates the problems which are introduced by seeding convective clouds in proximity of other echoes. While this did not show that the cloud was not seedable, at no time did the seeded region reach the reflectivities equivalent to the natural echoes on nearby storms. In the future, more vigilance is required on the part of both the aircraft and radar crews to avoid such anomalies. The results of these three analyses are evidence that the technology for seeding and studying single convective clouds is established. (Author)
W86-00307

3D. Conservation In Domestic and Municipal Use

MUNICIPAL WATER DEMANDS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Applied Economics.
For primary bibliographic entry see Field 6D.
W86-00275

3E. Conservation In Industry

INDUSTRIAL WATER DEMANDS,
Operational Economics, Inc., Houston, TX.
For primary bibliographic entry see Field 6D.
W86-00273

3F. Conservation In Agriculture

SEDIMENT TRANSPORT BY IRRIGATION RETURN FLOWS IN FOUR SMALL DRAINS WITHIN THE DID-18 DRAINAGE OF THE SULPHUR CREEK BASIN, YAKIMA COUNTY, WASHINGTON, APRIL 1979 TO OCTOBER 1981,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-00112

AGRICULTURAL WATER DEMANDS,
For primary bibliographic entry see Field 6D.
W86-00274

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ADVANCEMENT IN HYDRAULIC MODELING OF POROUS PAVEMENT FACILITIES,
Espey, Huston and Associates, Inc., Austin, TX.
For primary bibliographic entry see Field 2E.
W86-00098

PLANNING AND IMPLEMENTATION OF REGIONAL STORMWATER MANAGEMENT FACILITIES IN MONTGOMERY COUNTY, MARYLAND,
Greenhorne and O'Mara, Inc., Riverdale, MD.
J. M. Crouse, V. H. Berg, and L. J. Mitchell.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 255-271, 3 Fig, 4 Tab.

Descriptors: *Watershed management, *Model studies, *Runoff, *Storm runoff, *Erosion control, *Land development, *Urbanization, *Water quality management, Land use, Urban watersheds, Models, Sedimentation, Stream degradation, Storm water, Urban runoff, Detention reservoirs.

Increased flooding, accelerated channel erosion, and reduced water quality of streams in Montgomery County, Maryland due to urbanization and land development has led to the enactment of legislation requiring sediment control during land development. In 1971 the Montgomery Soil Conservation District (MSCD) adopted a stormwater management (SWM) policy requiring the detention of stormwater runoff from the 2-yr storm event on each development site. In 1973 control was mandated by the County's Department of Environmental Protection on a watershed basis. The remedial focus of the County SWM program includes projects to correct existing problems caused by uncontrolled runoff from previously developed areas as well as preventive programs to study the effects of proposed land use plans and their effects on stormflow throughout the watershed. In 1980 a stormwater management ordinance was enacted which relies heavily on the use of centralized SWM facilities which may serve a number of developments. The Cabin Branch study represents one of several case studies being conducted by the County to assess the effects of SWM on subwatersheds. Computerized hydrologic modeling was used to project peak discharges for various development and land use scenarios. Results of these studies indicate that three SWM facilities should be designed and constructed in the Cabin Branch Watershed at specific sites.
W86-00099

TIME-OF-TRAVEL DATA FOR NEBRASKA STREAMS, 1968 TO 1977,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-00120

IMPROVING TECHNOLOGY FOR CHEMICAL CONTROL OF AQUATIC PLANTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
K. K. Steward.
Miscellaneous Paper A-82-4, August 1982. Annual Report for FY 1980. Army Engineer Waterways Experiment Station, Vicksburg, MS. 51 p, 13 Fig, 15 Tab, 8 Ref, Append.

Descriptors: *Aquatic weed control, *Herbicides, *Weed control, 2,4-D, Water hyacinth, Hydrilla, Watermilfoil, Duckweed, Southern naiad, Fenac, Dichlobenil, Pesticides, Cabomba, Water lettuce, Polymers.

Several chemical aquatic weed control techniques were evaluated using a newly developed standard protocol. The release of 2,4-D from the MOE/GMA copolymer (2-methacryloyloxyethyl 2,4-dichlorophenoxyacetate glycerylmethacrylate) in flowing water following an initial application rate of 0.01 to 0.25 mg per liter was linear over 70 days. The compound was effectively phytotoxic to Eurasian watermilfoil for about 4 mo. A dichlobenil-beeswax controlled-released system produced rapid and inconsistent release of the herbicide. Two of three controlled-release fenac formulations were effective against hydrilla at 1.0 mg per liter in 10 wk and against Southern naiad at 1.0 mg per liter in about 8 wk. Cabomba was not controlled. Eurasian watermilfoil was controlled in 16 wk at 0.5 mg per liter. A coded compound (R0-3-7042) was effective against hydrilla over 16 wk at 1.0 mg per liter treatment rate and against Southern naiad in about 8 wk at 5.0 mg per liter. It was very effective against water lettuce at 1.0 mg per liter; marginally effective against water hyacinth; and ineffective against duckweed and cabomba. A growth retardant (EL-507) controlled water hyacinth at 1.0 kg per hectare.
W86-00183

PROCEEDINGS, 16TH ANNUAL MEETING, AQUATIC PLANT CONTROL RESEARCH PLANNING AND OPERATIONS REVIEW.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
November 17-19, 1981, St. Paul, Minnesota. Miscellaneous Paper A-82-3, June 1982. Final Report. 277 p.

Descriptors: *Weed control, *Aquatic weeds, *Biocontrol, *Herbicides, Aquatic plants, Water hyacinth, Watermilfoil, Hydrilla, Insects, Aquatic insects, Lake Conway, Florida, Fish, White amur, Grass carp, Ecological effects, 2,4-D, Pesticides, Model studies, Fate of pollutants, Wildlife, Parapoynx, Sameodes, Microorganisms, Pathogens, Dredging, HARVEST model, Mechanical control.

Mechanical, chemical, and biological control of aquatic weeds is included in this collection of research papers and weed control activities in regional districts of the Army Engineers. The Limnos mechanical harvesting system improved vertical water mixing and did not significantly decrease dissolved oxygen levels after harvest. The HARVEST mathematical model proved useful in evaluating effects of equipment and environmental conditions on harvesting. Chemical control methods included controlled-release 2,4-D formulations, structural investigation of a naturally occurring hydrilla inhibitor, and the fate of 2,4-D in water, sediment, and fish. Several biological controls proved potentially effective as weed control agents: Parapoynx (an aquatic moth), Sameodes albiguttalis, a variety of insects collected on overseas trips, and microorganisms. A method for surveying aquatic plants on a large scale was demonstrated in the Galveston, Texas, district. Application of endothall to watermilfoil and hydrilla proved most effective in spring. Large-scale operations management of aquatic weeds with white amur was studied in Lake Conway, Florida. The fish population controlled aquatic vegetation without major detrimental effects on native vertebrates or invertebrates. However, desirable vegetation was also eaten. The diver-operated dredge proved efficient for removing small populations of watermilfoil with little fragmentation.
W86-00192

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM PLANTS: SELECTED LIFE HISTORY INFORMATION OF ANIMAL SPECIES ON LAKE CONWAY, FL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
N. J. Zittleman, R. R. Williams, and E. G. Buglewicz.
Miscellaneous Paper A-82-5, August 1982. Final Report. 101 p, 16 Ref, 3 Append.

Descriptors: *Lakes, *Weed control, *Baseline studies, *Habitats, *Animals, Aquatic animals, Lake Conway, Florida, White amur, Grass carp, Fish, Aquatic weeds, Aquatic habitats, Birds, Fish, Mammals, Amphibians, Reptiles, Food habits, Nesting, Ecology, Biocontrol, Environmental effects, Fish management.

A baseline study of the animal species in Lake Conway, Florida, lists 180 species sighted or collected during January 1976 through September 1977. This is an early activity in the large-scale management test to document the effects of the introduction of the white amur fish for controlling aquatic weeds. Appendix A is a species list with scientific names for 35 fish, 54 birds, 7 mammals, and 28 herpetofauna. Appendix B describes the life history and managment information for each of the species. Appendix C concerns feeding, resting, and reproduction or nesting habitat requirements for the animals. In this list appear several categories with the numbers of the species fitting the category. For example, under food preferences of herpetofauna, 20 types of food are listed with the animal species that use each type.
W86-00197

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Group 4A—Control Of Water On The Surface

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS: THE HERPETOFAUNA OF LAKE CONWAY, SPECIES ACCOUNTS,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 6G.
W86-00202

2,4-D THRESHOLD CONCENTRATIONS FOR CONTROL OF EURASIAN WATERMILFOIL AND SAGO PONDWEED,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. F. Hall, H. E. Westerdahl, R. E. Hoeppel, and L. Williams.
Technical Report A-82-6, December 1982. Final Report. 20 p, 6 Fig, 3 Tab, 12 Ref.

Descriptors: *Weed control, *Aquatic weed control, *Herbicides, Aquatic plants, 2,4-D, Macrophytes, Watermilfoil, Pondweed, Diluter system.

The objective of this study was to use a modified diluter system to determine the minimum sustained (threshold) concentrations of 2,4-dichlorophenoxy acetic acid (2,4-D) required to control the growth of Eurasian watermilfoil (Myriophyllum spicatum L.) and Sago pondweed (Potamogeton pectinatus L.). This study was designed to incorporate recommended improvements and to verify results from a previous pilot study. The diluter system delivered five different concentrations of 2,4-D to five sets of four test aquaria. Another set of four reference aquaria received only tap water. Each aquarium contained meristematic cuttings of M. spicatum and germinated tubers of P. pectinatus planted in beakers containing a standard hydrosoil. Plant injury was assessed after 11 weeks of continuous exposure to the various 2,4-D concentrations. Based on the results of this study, the 2,4-D threshold concentrations required to control M. spicatum and P. pectinatus were determined to be 0.05 to 0.10 mg per liter and 0.10 to 0.25 mg per liter, respectively. This coincided with previous results obtained from a 6-week pilot study. (Author)
W86-00208

MISSION BAY HARBOR, CALIFORNIA, DESIGN FOR WAVE AND SURGE PROTECTION AND FLOOD CONTROL: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-00255

4B. Groundwater Management

USES OF RECHARGE WELLS IN WATER SUPPLY,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
J. H. Peters.
Journal of the American Water Works Association, Vol. 77, No. 5, p 47-51, 16 Fig, 16 Ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Water supply development, *Wells, Infiltration, Recharge wells, Groundwater flow, Computer models.

Recharge wells, wells by means of which a liquid can be put into the ground have many applications in the field of water supply. Recharge wells can be used for compensating locally for the drawdown of the water table or groundwater head, for regulating the flow of contaminated or salt groundwater, for limiting the catchment and protection zone of a groundwater pumping station and in the technique known as artificial recharge. With a system of recharge and pumping wells it is possible to reduce fluctuations in water quality. Hydrological aspects of three applications of recharge wells were studied using imaginary models, and computer models used to study the flow of groundwater were examined. The potential of recharge wells is not confined to the alternative they offer to open infiltration. Infiltrating pretreated surface water into the ground limits the impact of groundwater withdrawal on the environment and of the environment on groundwater withdrawal. (Baker-IVI)
W86-00006

WATER RESOURCES ON THE PUEBLO OF LAGUNA, WEST-CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-00108

GROUND-WATER RESOURCES OF AUDRAIN COUNTY, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-00113

GROUND-WATER CONDITIONS IN THE COTTONWOOD-WEST OAKLEY FAN AREA, SOUTH-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-00117

AVAILABILITY OF WATER FROM THE ALLUVIAL AQUIFER IN PART OF THE GREEN RIVER VALLEY, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-00126

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1981, VOLUME 1. HUDSON BAY BASIN.
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00129

4C. Effects On Water Of Man's Non-Water Activities

HISTORICAL CHANGES TO LAKE WASHINGTON AND ROUTE OF THE LAKE WASHINGTON SHIP CANAL, KING COUNTY, WASHINGTON,
Geological Survey, Seattle, WA. Water Resources Div.
For primary bibliographic entry see Field 2H.
W86-00105

OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS, 1978-JULY, 1981: CITATIONS FROM THE NTIS DATA BASE.
National Technical Information Service, Springfield, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-801357. December 1982. 271 p.

Descriptors: *Bibliographies, *Oil shale, *Industrial wastes, *Mine wastes, *Wastewater treatment, *Water pollution control, *Water quality control, Gasification, Pollutant identification, Leachates, Shales, Environmental effects, Ecological effects, Groundwater pollution, Streams, Aquifers, Water requirements.

This bibliography contains 366 abstracts of government-funded research on oil shale. Among the water-related subjects are water pollution control, waste and wastewater characterization and treatment, leachates, effect on groundwater and streamwater quality, health hazards, revegetation of disturbed soils, groundwater monitoring, environmental and ecological impacts, geochemistry, social and economic impacts, hydraulic fracturing, hydrologic aspects, and water consumption.
W86-00201

4D. Watershed Protection

EVALUATION OF A HYDROGRAPH SHIFTING METHOD FOR ESTIMATING SUSPENDED-SEDIMENT LOADS IN ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-00115

EVALUATION OF HYDROLOGIC PROCESSES AFFECTING SOIL MOVEMENT IN THE HAGERMAN FAUNA AREA, HAGERMAN, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2C
W86-00119

BUHNE POINT, HUMBOLDT BAY, CALIFORNIA, DESIGN FOR THE PREVENTION OF SHORELINE EROSION: HYDRAULIC AND NUMERICAL MODEL INVESTIGATIONS,
Coastal Engineering Research Center, Vicksburg, MS.
R. R. Bottin, and J. A. Earickson.
Technical Report CERC-84-5, November 1984. Final Report. 336 p, 14 Fig, 17 Tab, 142 Photos, 7 Plates, 26 Ref, 2 Append.

Descriptors: *Model studies, *Erosion control, *Beach erosion, *Structural models, *Hydraulic models, Channel erosion, Design criteria, Model, Numerical analysis, Jetties, Sediment transport, Breakwaters.

Two numerical and two physical models were used to study the effects of proposed improvement plans to rectify shoreline erosion at Buhne Point, Humboldt Bay. The numerical tidal circulation model showed that changes in tidal current velocities and flow patterns will be minimal due to proposed improvements. The numerical sediment transport model (CELC3D) showed that no net sediment transport patterns are induced by the optimum improvement plan. The 1:100-scale physical model of central Humboldt Bay showed that regardless of the incident wave approach from the Pacific Ocean, the angle of the wave front in the vicinity of Buhne Point remains essentially the same. This same model also indicated that the waves directly up the axis of the channel result in significantly larger wave heights in the vicinity of Buhne Point. The 1:50-scale physical model of Buhne Point was used to determine the cause of erosion at the point and the effectiveness of the various structures proposed for protection. Results showed that wave energy approaching the point from the jettied entrance to the bay eroded the original spit. Sediment eroded from the eastern part of the shoal and migrated westwardly when it entered the navigation channel. A reverse curve in the shore-connected breakwater where it originates from the existing Buhne Drive revetment (optimum plan) minimized wave convergence and runup in this area.
W86-00169

ANSWERS (AREAL NONPOINT SOURCE WATERSHED ENVIRONMENT RESPONSE SIMULATION) USER'S MANUAL.
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-115433. EPA-905/9-82-001, December 1981. Environmental Protection Agency, Chicago, IL. Great Lakes National Program Office. 54 p, 16 Fig, 3 Tab, 2 Ref, 4 Append. Contract/Grant No. EPA-G005335.

Descriptors: *Fate of pollutants, *Erosion control, *Soil conservation, *Model studies, *Watershed

anagement, *Nonpoint pollution sources, Agri-
ultural watersheds, Mathematical models, AN-
WERS model, Sediment transport, Hydrology,
and use, Sedimentation, Rainfall rate, Infiltration,
onservation.

his report is an expanded and edited version of
e Users Manual for the ANSWERS (Areal Non-
oint Source Watershed Environment Response
mulation) model, first published in September,
80. ANSWERS is a distributed parameter model
apable of predicting the hydrologic and erosion
sponse of primarily agricultural watersheds. Par-
cle-size distributions of the eroded sediment (at
l points in the watershed, as well as the outlet)
e available. The manual provides insights into
odel concepts, input requirements, output inter-
etation, and planning applications. (Author)
86-00287

WATER QUALITY MANAGEMENT AND PROTECTION

A. Identification Of Pollutants

NALYSIS OF PHENOLS BY CHEMICAL ERIVATIZATION. IV. RAPID AND SENSI-VE METHOD FOR ANALYSIS OF 21 HLOROPHENOLS BY IMPROVED CHLOR-ACETYLATION PROCEDURE,
nada Centre for Inland Waters, Burlington (On-
io).
-B. Lee, R. L. Hong-You, and A. S. Y. Chau.
urnal of the Association of Official Analytical
hemists, Vol. 68, No. 3, p 422-426, 1985. 3 Fig, 2
ab, 22 Ref.

escriptors: *Phenols, *Chlorophenols, *Chloroa-
tylation, *Water analysis, Chloracetic anhydride,
hemical analysis, Organic compounds, Gas chro-
atography, Chlorinated hydrocarbons.

quantitative, rapid, sensitive, and isomer-specific
ethod for the analysis of chlorophenols in natural
ater by in situ chloroacetylation was developed.
ithout pre-extraction, phenols in water are chlor-
cetylated by chloroacetic anhydride in the pres-
ce of K2CO3. Because of differences in reaction
hetics and stability, various chloroacetates were
moved from the reaction mixture at different
ervals. A more elaborate procedure was devel-
ed for cases where analysis of other classes of
utral organic compounds is also required; the
ocedure involves solvent extraction of organic
mpounds and back-extraction of phenols into
2CO3 solution followed by chloroacetylation.
hen a 12 m OV-1 fused silica capillary column
as used, 22 phenol chloroacetates were easily
olved in a single run. Using distilled and natural
ater samples, this method has been validated and
own to be applicable over a concentration range
0.1 to 100 micro-g/L of the phenols studied.
uthor's abstract)
86-00002

ULTIRESIDUE METHOD FOR THE ANALY-S AND VERIFICATION OF SEVERAL HER-CIDES IN WATER,
epartment of Agriculture, Regina (Saskatche-
an). Research Station.
J. Cessna, R. Grover, L. A. Kerr, and M. L.
dred.
urnal of Agricultural and Food Chemistry, Vol.
, No. 3, p 504-507, 1985. 2 Fig, 3 Tab, 11 Ref.

escriptors: *Pesticide residues, *Herbicides,
hemical analysis, *Detection limits, Water anal-
is, 2,4-D, Bromoxynil, Dicamba, MCPA, Pi-
oram, Triallate, Trifluralin, Gas chromatogra-
y.

ecause of the diversity of herbicide products
ailable, environmental water samples would best
analyzed for herbicide residues by using a mul-
esidue procedure. A multiresidue analytical
ethod to determine and verify residues of both
utral and acidic herbicides in water was devel-
ed. Acidic herbicides were derivatized by using diazomethane. Recoveries of herbicides (bromoxynil, 2,4-D, dicamba, MCPA, picloram, triallate, and trifluralin) from distilled water at fortification levels of 0.1-1 ppb ranged from 80 to 117%. Except for MCPA, all other herbicide residues could be verified by using two different detector modes. The method was used in a preliminary study to monitor herbicide residues in irrigation return flow waters at the Outlook Irrigation District (Saskatchewan). The supply water from the pumping station, monitored to provide background interferences for the various herbicides, consistently showed trace interferences at the retention time for 2,4-D which were less than the limit of detection. For the first two weeks of sampling, these interferences in the return flow water samples from the drainage ditches reflected what was found in the supply water. The average background interference in the 2,4-D region of the chromatogram was 0.13 ppb whereas those for the dicamba and bromoxynil regions were less than 0.1 ppb in both the supply water and in drainage ditch water prior to the commencement of spraying which occurred after the June 4 sampling; these backgrounds still permitted a limit of detection of 0.5 ppb for all three herbicides. The background interferences in the trifluralin and triallate regions readily permitted a limit of detection of 0.1 ppb. The method showed good reproducibility between duplicate water samples and these residues could be readily confirmed by using a specific gas chromatographic detector (the Hall detector in the halogen mode). (Collier-IVI)
W86-00046

RAPIDITY OF RNA SYNTHESIS IN HUMAN CELLS; A HIGHLY SENSITIVE PARAMETER FOR WATER CYTOTOXICITY EVALUATION,
Service de Controle des Eaux de la Ville de Paris (France).
C. Fauris, C. Danglot, and R. Vilagines.
Water Research, Vol. 19, No. 6, p 677-684, 1985. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *RNA synthesis, *Cytotoxicity testing, *Toxicity testing, *Water pollution effects, *Seine river, *Marne river, *Oise river, *France, Water analysis, Enzymes, Cell physiology, Animal physiology, Animal metabolism.

Effects of several water pollutants were tested, without any concentration, on the main cellular metabolic pathways of cultured human cells. The cellular targets studied were divided into four groups: the microsome and cytosol enzymes group (alkaline phosphatase, uridine kinase, thymidine kinase and ATPase); the mitochondrial enzymes group (ATPase and cytochrome oxidase); the isolated nuclei group (1 function); and the viable cells group (cytoplasmic membrane permeability and protein, RNA, and DNA synthesis). Each enzymatic activity or cellular function was tested in the presence of increasing concentrations of potassium dichromate, potassium cyanide, phenol, actinomycin D, sodium dodecyl sulfate, Triton X-100, and cupric sulfate. This comparison clearly indicated that the rapidity of cellular RNA synthesis was the most sensitive target to many pollutants. When used in the water field this quantitative test does not require preliminary concentration of the water's toxic compounds and, in the case of polluted river waters, requires sample dilution. Response of the test is fast enough to require only a 2 h incubation for highly cytotoxic samples and 20 h incubation for samples of low cytotoxicity. Its simplicity makes it easily adaptable to routine analysis and continuous monitoring of any water. Weekly cytotoxicity determinations were performed for two months on the river Seine at different sampling points around Paris (France) and on the river Marne and the river Oise. Chemical and physical tests were performed on the samples as well. The classification obtained by the whole of physicochemical analysis correlated well with the cytotoxicity testing. The application domain of the test is very large, ranging from surface and ground waters to drinking and bottled mineral waters. (Collier-IVI)
W86-00052

TRACER APPLICATIONS OF ULTRA-VIOLET ABSORPTION MEASUREMENTS IN COAST-AL WATERS,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 2L.
W86-00056

ESTIMATION OF PHOSPHORUS FLUX IN A REGULATED CHANNEL,
Inland Waters Directorate, Vancouver (British Columbia). Water Quality Branch.
L. J. Zeman, and H. O. Slaymaker.
Water Research, Vol. 19, No. 6, p 757-762, 1985. 3 Fig, 19 Ref.

Descriptors: *Phosphorus flux, *Okanagan River, *British Columbia, *Regulated flow, Nutrients, Annual distribution, Water sampling, Sampling strategy, Nutrient flux, Load distribution.

During a nutrient loading study in the Okanagan River Basin, British Columbia, the regression relationship between phosphorus concentrations and the Okanagan River discharge was shown to be not statistically significant. Phosphorus flux could, therefore, not be determined by conventional methods which rely on the concentration-discharge relationship. The reason for failure of conventional methods is the regulated nature of the Okanagan River flow. Two sampling strategies for chemical analysis of water samples were applied: (a) simultaneous, based on manual collection of sample replicates; and (b) sequential, using an automatic device to obtain a series of point concentration measurements. These sampling strategies provided a basis for nutrient flux estimation by the following methods; (a) partial load method, resulting from simultaneous sampling; and (b) flow interval method, based on sequential sampling. Load estimates and their confidence limits derived from the partial load method were compared with loads obtained by the flow interval method. There was a high level of correlation between the load estimates. Annual trends are more appropriately investigated by the flow interval method, cross-sectional load variability and confidence limits should be assessed by the partial load method. (Author's abstract)
W86-00062

ASSESSMENT OF HEAVY METALS AND PCB'S AT SELECTED SLUDGE APPLICATION SITES IN ONTARIO,
Department of the Environment, Ottawa (Ontario).
M. D. Webber, H. D. Monteith, and G. M. Corneau.
Environment Canada, Canada-Ontario's Agreement on Great Lakes Water Quality, Research Report No. 109, 1981. 27 p, 2 Fig, 10 Tab, 16 Ref.

Descriptors: *Fate of pollutants, *Bioaccumulation, *Sludge disposal, *Sludge utilization, *Grain crops, *Heavy metals, *Polychlorinated biphenyls. *Plant tissues, Path of pollutants, Land disposal, Metals, Cadmium, Zinc, Waste disposal, Molybdenum, Corn, Wheat, Oats, Ruminants, Solid waste disposal.

Ten sludge application sites were sampled during the summers of 1976 and 1978 for PCB and metal concentrations in soil and plants. Determinations of PCB and metal loadings showed that metal loadings exceeded the maxima recommended in the Ontario Sludge Utilization Guidelines at several sites. Sludge application increased the total metal and PCB contents and the DTPA-extractable metals in the soils. The largest increases generally coincided with the largest estimated loadings. The effects of sludge application on plants were minimal, except for an increase of Cd and Zn contents in plant materials. Stratford sludge contributed a heavy Mo loading and greatly increased the Mo content of corn leaves at that site. An exclusive diet of corn leaves from the Stratford site would cause Mo-induced Cu deficiency in ruminant animals. Increased Zn concentrations in plants would be desirable because Zn is usually deficient in plant and animal nutrition. However, increased Cd

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levels are undesirable because of the metal's toxicity to both plants and animals. Sludge application to land according to the Ontario Guidelines will not cause deleterious uptake of heavy metals by corn, oats and wheat.
W86-00102

WATER-QUALITY APPRAISAL, MAMMOTH CREEK AND HOT CREEK, MONO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. G. Setmire.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4060, 1984. 50 p, 15 Fig, 15 Tab, 6 Ref.

Descriptors: *Eutrophication, Dissolved oxygen, *Algal growth, *Mineralization, Nitrates, *Sedimentation, *Bacteria, *California, Mammoth Creek, Hot Creek, Mono County, *Mammoth Lakes.

A late summer reconnaissance in 1981 and a spring high-flow sampling in 1982 of Mammoth Creek and Hot Creek, located in the Mammoth crest area of the Sierra Nevada, indicated that mineralization, eutrophication, sedimentation, and limited areas of fecal contamination were occurring. Mineralization, indicated by a downstream increase in dissolved-solids concentration, was due primarily to geothermal springs that gradually decreased in the percentage of calcium, increased in the percentage of magnesium and sodium, and caused fluctuating, but overall increasing percentage of fluoride, sulfate, and chloride. Resulting water quality in Mammoth Creek was similar to that of the springs forming Hot Creek. Eutrophication was observed in Twin Lakes and the reach of Hot Creek below the fish hatchery. Twin Lakes had floating mats of algae and a high dissolved-oxygen saturation of 147 percent at a pH of 9.2. Hot Creek had excessive aquatic vascular plant and algae growth, dissolved-oxygen saturations ranging from 65 to 200 percent, algal growth potential of 30 milligrams per liter, and nitrates and phosphates of 0.44 and 0.157 milligrams per liter. Sedimentation was noted in observations of bed-material composition showing the presence of fine material beginning at Sherwin Creek Road. Fecal contamination was indicated by fecal coliform counts of 250 colonies per 100 milliliters and fecal streptococcal counts greater than 1,000 colonies per 100 milliliters. (USGS)
W86-00106

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE MOUNT SIMON-HINCKLEY AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-00109

QUALITY OF WATER, QUILLAYUTE RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-00111

INVESTIGATION OF WAIKELE WELL NO. 2401-01, OAHU, HAWAII: PUMPING TEST, WELL LOGS AND WATER QUALITY,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-00118

ASSESSMENT OF WATER RESOURCES IN LEAD-ZINC MINED AREAS IN CHEROKEE COUNTY, KANSAS, AND ADJACENT AREAS,
Geological Survey, Lawrence, KS. Water Resources Div.
T. B. Spruill.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-439, (1984). 102 p, 23 Fig, 26 Tab, 35 Ref.

Descriptors: *Mine drainage, *Groundwater contamination, *Stream pollution, *Groundwater hydrology, Water quality, *Water quantity, *Kansas, Cherokee, Lead and zinc mines.

A study was conducted to evaluate water-resource problems related to abandoned lead and zinc mines in Cherokee County, and adjacent areas in Oklahoma and Missouri. Discontinuities and perforations, which were produced by mining in the confining shale west of the Pennsylvanian-Mississippian geologic contact, have created artificial groundwater recharge and discharge areas. Abandoned wells and drill holes present the greatest contamination hazard to water supplies in the deep aquifer. There is a potential for downward movement from the shallow to the deep aquifer throughout the study area, with greatest potential in Ottawa County, Oklahoma. Principal effects of abandoned mines on groundwater quality are lowered pH and increased concentrations of sulfate and trace metals of water in the mines. No conclusive evidence of lateral migration of contaminated mine water from the mines into the water-supply wells adjacent to the mines was found. Analyses of water from the deep aquifer did not indicate trace-metal contamination. The effects of abandoned mines on streamwater quality are most severe in Short Creek and Tar Creek. Increased concentrations of zinc and manganese were observed in the Spring River below Short Creek Kansas. (USGS)
W86-00121

TREND ANALYSIS OF SALT LOAD AND EVALUATION OF THE FREQUENCY OF WATER-QUALITY MEASUREMENTS FOR THE GUNNISON, THE COLORADO, AND THE DOLORES RIVERS IN COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-00123

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1981, VOLUME 1. HUDSON BAY BASIN.
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-00129

CHEMISTRY FOR OPERATORS,
Muskegon County Board, MI. Dept. of Public Works.
For primary bibliographic entry see Field 5F.
W86-00134

LABORATORY PROTOCOLS FOR EVALUATING THE FATE OF ORGANIC CHEMICALS IN AIR AND WATER,
SRI International, Menlo Park, CA.
T. Mill, W. R. Mabey, D. C. Bomberger, T.-W. Chou, and D. G. Hendry.
EPA-600/3-82-022, July 1982. Environmental Research Laboratory, Athens, GA. 329 p, 21 Fig, 46 Tab, 287 Ref. Contract/Grant No. 68-03-2227.

Descriptors: *Fate of pollutants, *Testing procedures, *Air pollution, *Water pollution, *Organic compounds, Biotransformation, Oxidation, Aquatic habitats, Hydrolysis, Photolysis, Sorption.

Laboratory test procedures (or protocols) have been developed to provide data useful in evaluating the environmental fate of organic compounds in natural aquatic systems and in the atmosphere. Screening-level protocols are described to estimate rate constants for hydrolysis, photolysis, oxidation, biotransformation, volatilization processes in natural aquatic systems, and a screening protocol for measurement of partition coefficients for sorption of organic chemicals to sediments is also described. Detailed test protocols have been developed for the hydrolysis, photolysis, volatilization, and sediment-sorption processes to obtain more accurate and precise data for use in enviromental assessments applied to aquatic systems. Screening and detailed test protocols are described for estimating rate constants for the atmospheric photolysis and oxidation of organic compounds. For each process, the theory and the present state of knowledge regarding the environment are reviewed, and some common methods currently in use are critically evaluated. (Author)
W86-00154

MICROBIOLOGICAL WATER QUALITY OF IMPOUNDMENTS: A LITERATURE REVIEW,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
G. A. Burton.
Miscellaneous Paper E-82-6, December 1982. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 53 p 5 Tab, 210 Ref.

Descriptors: *Pollutant identification, *Water analysis, *Literature review, *Sampling, *Water quality, *Reservoirs, *Microbiologial studies, *Bacterial analysis, Water sampling, Indicators, Bioindicators, Coliforms, Public health, Diseases, Pathogens, Parasites, Viruses.

Assessing the microbiological water quality of impoundments and the potential for waterborne disease outbreaks is a difficult task when using traditional sampling programs. Problems associated with using fecal coliform bacteria as indicators of human pathogen presence complicates assessments of future water quality in preimpoundment areas. Reliable determination of future and present microbiological water quality requires knowledge of how the chemical, physical, and biological characteristics of the watershed and impoundment interrelate to influence microbial indicator and pathogen densities. Accurate estimates of microbial indicator and pathogen densities, obtainable by using the enumeration methods and their modifications suggested in this report, will allow monitoring of the proper indicator organisms and estimation of potential sites of pathogen occurrence, density, and survival. Sampling programs must be geared toward critical time periods and areas; i.e., summer months, storm flows, feeder streams, agricultural and urban runoff, and swimming areas, including water and sediments. Frequency of sampling should be dictated by variability of water conditions, confidence level of data, and extent of human contact. Choice of proper indicator organisms and enumeration methods and appropriate sampling strategies will allow sound preimpoundment assessment and reservoir management to greatly reduce the risk of waterborne disease outbreaks. (Author)
W86-00185

PROCEDURES FOR HANDLING AND CHEMICAL ANALYSIS OF SEDIMENT AND WATER SAMPLES,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
R. H. Plumb.
Technical Report EPA/CA-81-1, May 1981. Army Engineer Waterways Experiment Station, Vicksburg, MS. 482 p, 52 Fig, 32 Tab, 44 Ref. Contract Grant No. EPA-4805572010.

Descriptors: *Pollutant identification, *Chemical analysis, *Sediments, *Sampling, *Water analysis, Sample preparation, Sample preservation, Bottom sampling, Dredging, Organic compounds, Cation exchange capacity, Particle size, Hydrogen ion concentration, Oxidation-reduction potential, Inorganic compounds, Carbon, Metals, Nitrogen compounds, Ammonia, Phosphates, Sulfides, Carbonates, Chlorinated hydrocarbons, Oil, Pesticide, Insecticides, Herbicides, Phenolic compounds, Biochemical oxygen demand, Chemical oxygen demand, Sediment oxygen demand, Oxygen demand.

This handbook provides guidance for sampling, preservation, and analysis of dredged and fill material. Its emphasis is on regulatory affairs rather than research. Section 1 shows a project manage

the trade-offs involved in developing a sampling program. Factors which must be considered are sampling locations, sampling equipment, number of samples, types of tests, and specific chemical analyses. Section 2 shows laboratory and field personnel how to implement the sampling program. This includes the sample equipment and handling as well as the three general chemical tests: standard elutriate test, bulk analysis, and sediment fractionation. Section 3 gives details of analytical techniques for 44 parameters, including physical analysis (cation exchange capacity, particle size, pH, oxidation reduction potential, total and volatile solids, specific gravity), inorganic analysis (carbon, metals, nitrogen and compounds, phosphates, sulfides), organic analysis (carbamates, herbicides, insecticides, oil/grease, phenolics), chlorine demand, biochemical oxygen demand, chemical oxygen demand, and sediment oxygen demand.
W86-00198

MICROCOMPUTER ASSISTED QUALITY ASSURANCE,
Lotic Enterprises, Bakersfield, CA.
G. Hill.
1984, 106 p.

Descriptors: *Pollutant identification, *Wastewater treatment, *Water analysis, *Computer programs, *Quality control, *Statistical methods, Bacterial analysis, Chemical analysis, Physical analysis, Sampling, Standards, Standard deviation, Correlation analysis, Equations, Error analysis, Precision, Detention time, Corrosion, Larson/Langlier saturation index, Saturation index, Metric system, Mathematical studies.

Computer programs written in BASIC are given for quality assurance programs in water analysis and wastewater treatment laboratories. Each computer program includes a program description, documentation which the user must enter, the definition of variables, an example, a run, and a listing of the program. Some of the programs are organization of samples, typical report forms, internal standard method, standard addition (for determining low levels of the analyte), standard deviation, control charts, linear correlation coefficient, equation of the straight line, linear regression, linear interpolation from a single point, atomic absorption detection limits, percent recovery, mean error accuracy, anion-cation balance, feed rates, detention times, corrosive tendency, Larson/Langelier saturation index, and metric unit conversion.
W86-00203

METHODS FOR ECOLOGICAL TOXICOLOGY: A CRITICAL REVIEW OF LABORATORY MULTISPECIES TESTS.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W86-00210

MONITORING MARINE MICROBIAL FOULING.
National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
Technical Support Package, MFS-25928, Spring 1984. 23 p, 1 Tab.

Descriptors: *Pollutant identification, *Microorganisms, *Fouling, *Bacterial analysis, *Microbiological studies, Microscopy, Films.

A method for monitoring biofouling on metal surfaces and nylon parachute material immersed in seawater was developed. It involves a combination of scanning electron microscopy and isolation, enumeration, and identification of biofouling microorganisms, using standard microbiological culture methods. Marine biofouling increases with length of exposure of the water and with water temperature. The polysulfide sealant and nylon parachute material were more readily biofouled than metallic surfaces. Spray washing was not effective for removing deposits of organic biofilm.
W86-00227

SAMPLING FREQUENCY - MICROBIOLOGICAL DRINKING WATER REGULATIONS: FINAL REPORT,
Drexel Univ., Philadelphia, PA. Dept. of Biological Sciences.
W. O. Pipes, and R. R. Christian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-127738. EPA/570/9-82-001, September 1982. Environmental Protection Agency, Washington, DC. Office of Drinking Water. 174 p, 22 Fig, 70 Tab, 25 Ref, Append.

Descriptors: *Pollutant identification, *Water analysis. *Water distribution, *Sampling, *Bacteria, Coliforms, Microorganisms, Monitoring, Microbiological studies.

A sampling model was developed to specify the sampling frequency needed to determine compliance with the microbiological maximum contaminant levels of the Natinal Interim Primary Drinking Water Regulations. Two approaches were used: empirical, based on fitting coliform data to frequency distributions; and mechanistic, done by analyzing the physical elements of the system to determine the distribution of coliforms throughout a water system. In the empirical approach the truncated lognormal distribution was chosen. In this case coliform densities $< 1/100$ ml or $> 80/100$ ml cannot be measured. The probability of violation is a function of the densities of coliforms, the number of samples collected, and the parameters of the lognormal distribution. Therefore a higher degree of aggregation of coliform bacteria leads to larger numbers of samples being needed for detection of contamination. The mechanistic approach showed that the water distribution system could be divided into hydraulically isolated sections. It was concluded that all sections must be included in the monitoring program to get an accurate measure of coliform occurrence. Coliform occurrence did not differ between peripheral and nonperipheral locations or with distance from the water source. Thus sampling locations for a microbiological monitoring program can be selected on a randomized basis.
W86-00245

ADDENDUM TO HANDBOOK FOR SAMPLING AND SAMPLE PRESERVATION.
Environmental Monitoring and Support Lab.-Cincinnati, OH.
EPA-600/4-83-039, August 1983, 28 p, 3 Tab.

Descriptors: *Water analysis, *Pollutant identification, *Sampling, *Water sampling, *Sample preparation, *Monitoring, Sample preservation, Preservation, Monitoring, Water analysis.

This addendum has an updated and expanded Table 2.3, listing automatic samplers and their characteristics. In addition, the definitions of sample types (discrete, composite, flow proportional composite, hand proportioned composite, sequential composite, and continuous composite) have been revised. Additional references on samplers and sampling are listed.
W86-00268

SAMPLING AND DETECTION OF TAGGED DREDGED MATERIAL,
Argonne National Lab., IL. Energy and Environmental Systems Div.
L. S. Van Loon, D. L. McCown, and J. D. Ditmars.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82016056. ANL/EES-TM-169, January 1982. 29 p, 17 Fig, 5 Ref. Contract/Grant No. W-31-109-Eng-38.

Descriptors: *Pollutant identification, *Dredging, *Sediment transport, Sand, Sampling, Ultraviolet radiation, Fluorescence.

Systems for sampling and detecting tagged dredged sand in the Upper Mississippi River were develped by Argonne National Laboratory for the U.S. Army Corps of Engineers, Rock Island District. The Corps plans to demonstrate main-channel disposal of dredged material, and it requires systems to detect the movement of the dredged material after the material has been placed in a deep reach of river. The dredged material in the demonstration will be tagged with sand particles coated with fluorescent dye. Argonne designed systems for sampling of the bottom surficial sediments at discrete points along transects from a boat that employs a precision navigation system; onboard visual inspection of the samples for dyed sand in an ultraviolet light box; and photography of ultraviolet-illuminated samples. This report describes the systems and their uses as well as the results of tests to determine proper settings for photographic equipment. (Author)
W86-00288

5B. Sources Of Pollution

AVERAGE RAINWATER PH, CONCEPTS OF ATMOSPHERIC ACIDITY, AND BUFFERING IN OPEN SYSTEMS,
Texas Univ. at Austin. Dept. of Environmental Health Engineering.
H. M. Liljestrand.
Atmospheric Environment, Vol. 19, No. 3, p 487-499, 1985. 4 Fig, 2 Tab, 24 Ref, 2 Append. EPA grant R810148-01 and California Air Resources Board grant A7-110-30.

Descriptors: *Acid rain, *Chemistry of precipitation, *Hydrogen ion concentration, *Chemical reactions, *Buffering, Carbon dioxide, Ammonia, Hydrochloric acid, Nitrates, Sulfur dioxide, Carbonate, Air pollution.

The system of water equilibrated with a constant partial pressure of CO2, as a reference point for pH acidity-alkalinity relationships, has nonvolatile acidity and alkalinity components as conservative quantities, but not H(+) concentration. Simple algorithms were developed for the determination of the average pH for combinations of samples both above and below pH 5.6. Averaging the nonconservative quantity H(+) concentration yields erroneously low mean pH values. To extend the open CO2 system to include other volatile atmospheric acids and bases distributed among the gas, liquid and particulate matter phases, a theoretical framework for atmospheric acidity was developed. Within certain oxidation-reduction limitations, the total atmospheric acidity (but not free acidity) is a conservative quantity. The concept of atmospheric acidity was applied to air-water systems approximating aerosols, fogwater, cloudwater and rainwater. The buffer intensity in hydrometeors is a function of net strong acidity, partial pressures of acid and base gases and the water to air ratio. For high liquid to air volume ratios, the equilibrium partial pressures of trace acid and base gases are set by the pH or net acidity controlled by the nonvolatile acid and base concentrations. For low water to air volume ratios as well as stationary state systems such as precipitation scavenging with continuous emissions, the partial pressures of trace gases (NH3, HCl, HNO3, SO2 and CH3COOH) appear to be of greater or equal importance as carbonate species as buffers in the aqueous phase. (Author's abstract)
W86-00001

CHLORINATED ORGANICS IN SIMULATED GROUNDWATER ENVIRONMENTS,
Florida International Univ., Miami. Drinking Water Research Center.
F. Parsons, and G. B. Lage.
Journal of the American Water Works Association, Vol. 77, No. 5, p 52-59, May, 1985. 9 Fig, 7 Tab, 27 Ref.

Descriptors: *Chlorinated hydrocarbons, *Groundwater, *Biotransformation, *Degradation, Biodegradation, Fate of pollutants, Trichloroethane, Tetrachloromethane, Trichlormethane, Dichloroethane.

Tetrachloromethane and 1,1,1-trichloroethane were transformed in microcosms composed of aquifer materials to trichloromethane and 1,1-dichloroethane, respectively. Further observations of tri- and tetrachloroethane in microcosms demonstrated

the transformation of these compounds to dichloroethane. Biotransformation products of these four solvents by freshwater sediment microbiota, in sealed static microcosms, were determined by gas chromatography during incubation at ambient temperatures in the dark for periods of up to 16 weeks. Under conditions of neutral to acid pH, reductive potential, and the absence of oxygen and light, reductive dehalogenation of these four compounds occurred. Chlorinated alkenes were consistently more resistant to biotransformation than the chlorinated alkanes. (Author's abstract)
W86-00007

AWWA SURVEY OF INORGANIC CONTAMINANTS IN WATER SUPPLIES.
For primary bibliographic entry see Field 5F.
W86-00009

SURFACE BUOYANT JETS IN STEADY AND REVERSING CROSSFLOWS,
Worcester Polytechnic Inst., Holden, MA. Alden Research Labs.
D. N. Brocard.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 793-809, May, 1985. 10 Fig, 2 Tab, 19 Ref.

Descriptors: *Buoyant jets, *Crossflows, *Plumes, *Heated water, Path of pollutants, Buoyant spreading, Boundary effects, Water currents.

Data on suface buoyant jets in steady and reversing crossflows was obtained with experiments conducted in a 130 ft (40 m) by 81 ft (25 m) by 1.5 ft (0.45 m) deep basin, which was large enough to ensure negligible boundary effects while allowing controlled ambient conditions. The test results are presented nondimensionally and referenced to controlling length scales. The steady crossflow results are trajectories and longitudinal temperatures, which show the effects of the discharge buoyancy and initial flow rate. Comparing these results with those of other experimental studies leads to the suspicion that boundary effects may be present in some of the latter. The reversing crossflow tests furnish surface temperature patterns and plume depths for a range of conditions. These results can be used to evaluate mathematical models. In addition, the effects of tidal reversal on the offshore extent and depth of the plume are examined. Dispersion tests reveal that buoyancy played an important role in plume spreading. This factor is important as buoyant spreading is frequently omitted in two dimensional farfield mathematical models of thermal plumes. (Author's abstract)
W86-00014

DISPERSION IN ANISOTROPIC, HOMOGENEOUS, POROUS MEDIA,
Baghdad Univ. (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 2F.
W86-00015

INITIAL DILUTION FOR OUTFALL PARALLEL TO CURRENT,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
J. B. Hinwood, and I. G. Wallis.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 828-845, May, 1985. 7 Fig, 2 Tab, 10 Ref, 2 Append. Australian National Energy Research Development and Demonstration Council grant 78/2799.

Descriptors: *Outfalls, *Dilution, *Currents, *Diffusers, Thermal pollution, Wastewater outfall, Plumes, Buoyancy.

Rotary tidal currents or site constraints can result in an outfall diffuser being alined with the current in shallow water. Experiments using a small model laboratory diffuser flume and a much larger scale model in an estuarine channel were used to establish the significant processes causing initial dilution of effluent discharged from a multiport diffuser alined parallel to the ambient current. From considerations of momentum conservation and mixing, and the results of the flume experiments, an expression for the initial dilution in shallow water was obtained the conditions defining shallow water were established. The results of the field experiments carried out in an estuarine channel were in agreement with the laboratory results and verified the derived expression. A relationship between the initial dilution and the angle between the diffuser and the current was developed from the field studies. (Author's abstract)
W86-00016

REGIONAL UNSTEADY INTERFACE BETWEEN FRESH WATER AND SALT WATER IN A CONFINED COASTAL AQUIFER,
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
For primary bibliographic entry see Field 2F.
W86-00042

FATE OF ALDICARB, ALDICARB SULFOXIDE, AND ALDICARB SULFONE IN FLORIDAN GROUNDWATER,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
C. J. Miles, and J. J. Delfino.
Journal of Agricultural and Food Chemistry, Vol. 33, No. 3, p 455-460, 1985. 4 Fig, 3 Tab, 28 Ref.

Descriptors: *Aldicarb, *Pesticides, *Florida, *Groundwater contamination, *Fate of pollutants, Chemical reactions, Degradation, Hydrolysis, Limestone, Biodegradation, Microcosms.

The fate of aldicarb, aldicarb sulfoxide, and aldicarb sulfone in Floridan groundwater microcosms was determined. One reaction mechanism observed was base hydrolysis and degradation rates decreased in the order, sulfone > sulfoxide >> aldicarb. Appearance of oximes followed the disappearance of corresponding parent compounds while appearance of nitriles was minor and rarely observed. Microcosms amended with crushed limestone showed rates of hydrolysis that were 4-5 times slower than microcosms without limestone. Oxidation of aldicarb to the sulfoxide was minimal within 70 days whereas in separate experiments, the reduction of the sulfoxide to aldicarb was significant over the same time period. The sorption of aldicarb, aldicarb sulfoxide, and aldicarb sulfone onto limestone was not observed. (Author's abstract)
W86-00045

LABORATORY AND FIELD STUDIES ON THE FATE OF 1,3,6,8-TETRACHLORODIBENZO-P-DIOXIN IN SOIL AND SEDIMENTS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. C. G. Muir, A. L. Yarechewski, R. L. Corbet, G. R. B. Webster, and A. E. Smith.
Journal of Agricultural and Food Chemistry, Vol. 33, No. 3, p 518-523, 1985. 1 Fig, 6 Tab, 21 Ref.

Descriptors: *Dioxins, *Sediments, *Soil, *Fate of pollutants, Degradation products, Carbon radioisotopes, Isotope studies, Lake sediments.

The fate of C-14-ring-labeled 1,3,6,8-tetrachlorodibenzo-p-dioxin (TCDD) was studied in sandy loam soil under field conditions and in silty-clay pond and lake sediments under laboratory conditions. Dissipation of 1,3,6,8-TCDD from small field plots was relatively rapid with 44% of the applied radioactivity lost after 131 days post-treatment. In sediment, 80% of the radioactivity could still be accounted for as intact chemical after 675 days under static aerobic conditions (10 and 25 C) or after 310 days under a nitrogen or air purge. Transformation of 1,3,6,8-TCDD to degradation products and unextractable radioactivity in soils and sediments was very slow. Unidentified polar products represented a maximum of 2.5% of extractable C-14 in field soils and 7.0% in sediments. DDT incubated in sediments under the same conditions had half-lives of < 310 days. (Author's abstract)
W86-00047

HETEROTROPHIC SLIMES IN IRISH RIVERS, EVALUATION OF THE PROBLEM,
Trinity Coll., Dublin (Ireland). Environmental Sciences Unit.
N. F. Gray, and C. A. Hunter.
Water Research, Vol. 19, No. 6, p 685-691, 1985. 2 Fig, 10 Tab, 14 Ref.

Descriptors: *Slimes, *Fungus, *Heterotrophic slimes, *Ireland, *Rivers, Surveys, Water pollution effects, Fish kills, Odors.

A questionnaire survey was used to determine the frequency of occurrence, extent and duration of slime growth in Irish rivers. Other factors such as the source of slime-promoting effluents, the degree of treatment given to effluents prior to discharge and the effects slime growth was having on watercourses were also examined. 156 outbreaks were recorded throughout Ireland which affected approx 350 km of channel. Discharges from the agricultural processing industry and domestic sewage were most frequently associated with slime outbreaks. Few of the outbreaks were insignificant in length with 33.7% in excess of 1 km and 13.5% in excess of 5 km. Although 12.6% of outbreaks resulted in no adverse effects on watercourses, major problems reported included the appearance and amenity value being adversely affected (86.4%), smell and deoxygenation (46.6%), damage to fish stocks (37.9%) and problems of sloughed flocs of slime (24.3%). The severity of these adverse effects was directly related to the length of outbreaks. The situation in Ireland was compared to England and Wales. (Author's abstract)
W86-00053

GROUNDWATER SEEPAGE NUTRIENT LOADING IN A FLORIDA LAKE,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 2H.
W86-00065

RELEASE OF ENDOTHALL FROM AQUATHOL GRANULAR AQUATIC HERBICIDE,
North Texas State Univ., Denton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5G.
W86-00068

ALTERNATING DIRECTION GALERKIN TECHNIQUE FOR SIMULATION OF CONTAMINANT TRANSPORT IN COMPLEX GROUNDWATER SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences
A. D. Daus, and E. O. Frind.
Water Resources Research Vol. 21, No. 5, p 653-664, May, 1985. 14 Fig, 2 Tab, 20 Ref. Natural Sciences and Research Council of Canada operating grant A8368.

Descriptors: *Contamination, *Path of pollutant, *Solute transport, Finite element method, Computers, Simulation, Groundwater flow, Groundwater pollution.

A general contaminant transport simulation technique based on a Galerkin finite element representation in space and an alternating direction time stepping scheme is developed. The formulation which is in terms of natural coordinates following the principal directions of hydraulic conductivity of the medium, decouples the spatial components of the equations, leading to tridiagonal matrices. The numerical accuracy can be easily controlled in each principal direction through the well-established Peclet and Courant numbers. The ADC technique showed excellent potential for application to a variety of groundwater contamination scenarios. Applied to an isotropic, homogeneous system, it possesses the same favorable performance characteristis as the PD method of Frind and Pinder. These include delivery of equal or better accuracy compared with the conventional two dimensional finite element technique; control over numerical dispersion through the Peclet and Courant criteria; independence of the numerical accuracy on the element aspect ratio; and low operations count, low core storage requirements, a

low solution roundoff error. The ADG2 technique possesses some distinct advantages over the P method; a grid that is invariant in time; applicability to transient flow conditions; and an ability to handle anisotropic flow systems and complex stratigraphy. The ADG2 technique retains both the flexibility of the finite element method and the efficiency of the alternative direction technique. Because of its simple structure and the absence of large banded matrices, the algorithm could provide a base for more complex modes such as those combining geochemical reactions with advective-dispersive transport. (Baker-IVI)
W86-00072

ANALYSIS AND INTERPRETATION OF SINGLE-WELL TRACER TESTS IN STRATIFIED AQUIFERS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-00074

ONE-DIMENSIONAL ANALYTICAL SOLUTIONS FOR THE MIGRATION OF A THREE-MEMBER RADIONUCLIDE DECAY CHAIN IN A MULTILAYERED GEOLOGIC MEDIUM,
Battelle Project Management Div., Columbus, OH. Office of Nuclear Waste Isolation.
A. B. Gureghian, and G. Jansen.
Water Resources Research, Vol. 21, No. 5, p 733-742, May, 1985. 9 Fig, 3 Tab, 13 Ref, 2 Append.

Descriptors: *Path of pollutants, *Groundwater pollution, *Radioactive wastes, Transport, Waste disposal, Radionuclides, Laplace equation, Computers.

The Laplace transform method was used to analytically solve the one-dimensional transport equation of a three-member decay chain in a stratified geologic medium. The solution for the nondispersive case is exact. The solution for the general case, although analytic in the first layer, takes a semianalytical form in the subsequent layers by virtue of its numerical integration requirements. Two types of boundary conditions are considered at the source, i.e., a continuous and a band release mode. The accuracy of the solutions was satisfactorily tested on a selected number of problems for which experimental and analytical solutions were available. The practical use of the solutions in a two-dimensional domain is illustrated by a scenario of radionuclide migration from a high level waste repository located in a saturated multilayered aquifer. The computational scheme was programmed in FORTRAN IV and executed on a CDC/CYBER-74-NOS-BE operating system. (Baker-IVI)
W86-00081

SEDIMENT-WATER INTERFACE IN MODELING PESTICIDES IN SEDIMENTATION PONDS,
Princeton Univ., NJ. Dept. of Civil Engineering.
P. R. Jaffe, and R. A. Ferrara.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 53-64, 6 Fig, 1 Tab, 4 Ref.

Descriptors: *Model studies, *Bottom sediments, *Sedimentation, *Pesticide kinetics, *Sediment transport, *Adsorption, *Fate of pollutants, *Sedimentation basins, Settling basins, Pesticides, Models, Simulation analysis, Partition coefficient, Particulate matter, Path of pollutants.

A model was developed to study what effect a sedimentation pond may have on the pesticide load carried via sediment transport to receiving waters. The water column of the pond is represented as a completely mixed system. To model this system, equations are required to describe the changes in volume, suspended sediments, adsorbed pesticide concentration, dissolved pesticide concentration, and pesticide concentration in the bottom sediments. Results of several simulations showed that the peak concentration of pesticides in the sedimentation pond is about 3% of the peak storm runoff concentration without a pond. If the partition coefficient is increased, the reduction of the peak concentration is even higher, indicating the improved removal efficiency of the sedimentation process. If no decay occurs, the total yearly load to the receiving waters will be the same with or without a pond once final conditions occur (after a few seasons). If some decay occurs, the total yearly load at final conditions will be less with a pond than without one.
W86-00088

MIXING ZONE MODEL FOR CONSERVATIVE PARAMETERS,
Oklahoma Water Resources Board, Oklahoma City.
For primary bibliographic entry see Field 5G.
W86-00089

SOME RECENT ADAPTATIONS AND APPLICATIONS OF QUAL-II IN THE NORTHEAST,
W. W. Walker.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 87-101, 5 Fig, 1 Tab, 22 Ref.

Descriptors: *Computer models, Models, *Model studies, *Water quality, *Dissolved oxygen, *Nitrogen, *Phosphorus, *Nutrients, Waste load, Rivers, River basins, Simulation analysis, Phytoplankton, Ammonia, Algae.

The modifications of the QUAL-II model to improve simulations of dissolved oxygen conditions in rivers heavily impacted by photosynthesis are discussed along with recent applications of the model in New England. To improve simulations of phytoplankton, nutrients, and oxygen compartments were added for detrital organic P and organic N, algal uptake of ammonia and/or nitrate N, self-shading by phytoplankton, and specification of alternative nutrient limitation by N or P. The Vermont Agency of Environmental Conservation used the QUAL-II model during a wasteload allocation study on the Winooski River when assessing the possible requirements for advanced waste treatment. The Sebasticook River study examined the impacts of a combined municipal/industrial discharge on a small stream (upper east branch) which discharges into an inlet of Lake Sebasticook, a eutrophic Maine lake. The model was also applied to the Sudbury/Concord Rivers in Massachusetts as part of an assessment of the potential environmental constraints involved in diverting waters from the upper watershed for water supply purposes. Interfacing the model output with SAS and plotting routines facilitates calibration, testing, and statistical analysis of observed and predicted water quality profiles. The revised code can be used on microcomputers or mainframes with FORTRAN capability.
W86-00090

REVIEW OF MODEL USE IN EVALUATING NONPOINT SOURCE LOADS FROM FOREST MANAGEMENT ACTIVITIES,
National Council of the Paper Industry for Air and Stream Improvement Inc., New York.
G. G. Ice, and R. C. Whittemore.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 102-122, 6 Fig, 7 Tab, 24 Ref.

Descriptors: *Forest management, *Forest watersheds, Sediments, Erosion, *Nonpoint pollution sources, *Model studies, *Hydrologic models, *Water quality management, *Channel erosion, Water quality, *Soil erosion, Erosion, Landslides, Models, Prediction, Stream degradation.

There is currently an urgent need to validate models that predict water quality, streambed, and stream biota responses to forest practices due to the Clean Water Act and the diverse silvicultural nonpoint source (NPS) control programs developed under Section 208. In addition to regulatory requirements for the use of models, the forestry community has recently begun to consider the consequences of multiple forest operations on water quality. Models are needed to predict not only changes in sediment concentration (the traditional NPS measure for forest practice impacts on water quality) but also changes in channel conditions and the beneficial uses of the water. In response to these demands, the EPA published 'An approach to Water Resources Evaluation of Nonpoint Silvicultural Sources' (WRENSS) in 1980. The sediment prediction components of WRENS include models for water quantity, surface erosion, landslides, and total potential sediment and channel modification. The National Council for Air and Stream Improvement (NCASI) has used WRENSS to predict baseline sediment yields from undisturbed basins. NCASI is collecting data from landslide surveys to evaluate predictive methods. The Siuslaw National Forest procedures predict a number of forest-wide responses to various stresses. The areas where model development are needed are identified along with research programs that would enhance understanding of forest water quality modeling.
W86-00091

MECHANISTIC SIMULATION FOR TRANSPORT OF NONPOINT SOURCE POLLUTANTS,
Simons, Li and Associates, Inc., Fort Collins, CO.
D. B. Simons, R.-M. Li, and K. G. Eggert.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 146-160, 5 Fig, 13 Ref.

Descriptors: *Model studies, *Watershed management, *Erosion, *Simulation analysis, *Nonpoint pollution sources, *Fate of pollutants, *Path of pollutants, Watersheds, Nutrients, Organic matter, Dissolved solids, Pesticides, Sediments, Stream degradation, Bank erosion, Channel erosion.

A simulation model for evaluation of alternative management parameters is presented. The model may be used to predict watershed response to land use, including both planned and unplanned events. Nonpoint source pollution from these events may include loading of streams by sediment from erosion, thermal energy, biological contaminants, organic debris, nutrients and dissolved solids, pesticides, and other wastes in solution or adsorbed to sediments. The simulation consists of a soil-plant-atmospheric water simulation for adjusting soil moisture as a function of evaporation, evapotranspiration, soil water hydraulics, and snowmelt, and a kinematic wave surface water routing component. Other model compartments predict hydraulically-based sediment yield, subsurface flow, temperature and dissolved oxygen, pollutant routing and streambank erosion and forest litter routing. This preliminary planning model should be useful in evaluating selected alternatives as a function of environmental goals.
W86-00092

ASSESSMENT OF HEAVY METALS AND PCB'S AT SELECTED SLUDGE APPLICATION SITES IN ONTARIO,
Department of the Environment, Ottawa (Ontario).
For primary bibliographic entry see Field 5A.
W86-00102

NUTRIENT INPUT FROM THE LOXAHATCHEE RIVER ENVIRONMENTAL CONTROL DISTRICT SEWAGE-TREATMENT PLANT TO THE LOXAHATCHEE RIVER ESTUARY, SOUTHEASTERN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. H. Sonntag, and B. F. McPherson.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4020, 1984. 23 p, 3 Fig, 8 Tab, 4 Ref.

Descriptors: *Effluents, *Nutrients, Water quality, Loxahatchee River estuary, *Florida, *Estuaries, *Sewage effluents.

Two test discharges of treated-sewage effluent were made to the Loxahatchee River in February and September 1981 from the ENCON sewage-treatment plant to document nutrient loading and downstream transport of the effluent to the estuary under maximum daily discharge allowable by law (4 million gallons per day). Concentrations of total nitrogen in the effluent exceeded background concentrations by as much as 7 times during the February test, while concentrations of total phosphorus exceeded background concentrations by as much as 112 times during the September test. The effluent was transported downstream to the estuary in less than 24 hours. Discharge of treated sewage effluent to the river-estuary system in the 1981 water year accounted for less than 0.5 percent of the total nitrogen and 8 percent of the total phosphorus discharged from the major tributaries to the estuary. If maximum discharges of effluent (4 million gallons per day) were sustained throughout the year, annual nitrogen loading from the effluent would account for 5 to 18 percent of the total nitrogen input by the major tributaries to the estuary. With maximum discharges of effluent, annual phosphorus loading would exceed the amount of phosphorus input by the major tributaries to the estuary by 54 to 167 percent. (USGS)
W86-00110

ASSESSMENT OF WATER RESOURCES IN LEAD-ZINC MINED AREAS IN CHEROKEE COUNTY, KANSAS, AND ADJACENT AREAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-00121

DIGITAL SIMULATION OF THE REGIONAL EFFECTS OF SUBSURFACE INJECTION OF LIQUID WASTE NEAR PENSACOLA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. L. Merritt.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4042, 1984. 73 p, 19 Fig, 1 Tab, 30 Ref.

Descriptors: *Liquid wastes, *Injection, *Waste disposal, *Water pollution effects, *Hydraulic models, *Computer models, *Florida, Water pollution sources, Injection effects, Floridan aquifer.

Industrial, organic, liquid waste has been injected into a part of the lower limestone of the Floridan aquifer at one site since 1963 and at another site since 1975, raising water levels in the injection zone throughout a large region. The hydrogeologic conceptual model of the injection zone is a layer tightly confined above by a thick layer of clay and in which lateral hydraulic conductivity decreases rapidly below the upper 60 feet. Recharge areas are to the north and east, where the confining layer pinches out. There appear to be permeability barriers to the northwest, west, and southwest due to facies changes, faults, or pinchouts. Measured and reconstructed preinjection water levels suggested that flow in the aquifer is from the northern recharge areas toward the southeast. A steady-state model simulation incorporating the cited boundary assumptions approximately simulated this pattern. A two-dimensional flow model and the subsurface waste injection program (SWIP) were calibrated to simulate the water level increases at various monitor wells since 1963. Sensitivity analyses showed the simulations to be quite sensitive to moderate errors in either transmissivity or storage parameter specifications. The predictive use of the hydraulic model is understood to be restricted to the geographical locations of data used for model calibration. (USGS)
W86-00122

TREND ANALYSIS OF SALT LOAD AND EVALUATION OF THE FREQUENCY OF WATER-QUALITY MEASUREMENTS FOR THE GUNNISON, THE COLORADO, AND THE DOLORES RIVERS IN COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Kircher, R. S. Dinicola, and R. F. Middelburg.
Available from the OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4048, 1984. 69 p, 20 Fig, 15 Tab, 16 Ref.

Descriptors: *Statistical methods, *Regression analysis, Network design, *Water-quality data, *Salinity, *Colorado, *Utah, Colorado River basin, *Trend analysis.

Monthly values were computed for water-quality constituents at four streamflow gaging stations in the Upper Colorado River basin for the determination of trends. Seasonal regression and seasonal Kendall trend analysis techniques were applied to two monthly data sets at each station site for four different time periods. A recently developed method for determining optimal water-discharge data-collection frequency was also applied to the monthly water-quality data. Trend analysis results varied with each monthly load computational method, period of record, and trend detection model used. No conclusions could be reached regarding which computational method was best to use in trend analysis. Time-period selection for analysis was found to be important with regard to intended use of the results. Seasonal Kendall procedures were found to be applicable to most data sets. Seasonal regression models were more difficult to apply and were sometimes of questionable validity; however, those results were more informative than seasonal Kendall results. The best model to use depends upon the characteristics of the data and the amount of trend information needed. The measurement-frequency optimization method had potential for application to water-quality data, but refinements are needed. (USGS)
W86-00123

PRELIMINARY APPRAISAL OF SEDIMENT SOURCES AND TRANSPORT IN KINGS BAY AND VICINITY, GEORGIA AND FLORIDA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-00125

RUNOFF, SEDIMENT TRANSPORT, AND WATER QUALITY IN A NORTHERN ILLINOIS AGRICULTURAL WATERSHED BEFORE URBAN DEVELOPMENT, 1979-81,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-00133

COEFFICIENTS FOR USE IN THE U.S. ARMY CORPS OF ENGINEERS RESERVOIR MODEL, CE-QUAL-R1,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
C. D. Collins, and J. H. Wlosinski.
Technical Report E-83-15, October 1983. Final Report. 120 p, 39 Tab, 357 Ref.

Descriptors: *Data collections, *CE-QUAL-R1, *Computer programs, Algorithms, Reservoirs, Water quality, Respiration, Mortality, Decomposition.

This report supplies information about, and literature values for, many of the coefficients needed for the U.S. Army Corps of Engineers Reservoir Model, CE-QUAL-R1. Most of the information presented concerns biological processes of gross production, ingestion, respiration, mortality, and decomposition. Coefficients specified are suitable for the algorithms described in the Instruction Report E-82-1 entitled CE-QUAL-R1: A Numerical One-Dimensional Model of Reservoir Water Quality: User's Manual,' available from the Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss. (Author)
W86-00153

EFFECTS OF ACID RAIN ON SOIL AND WATER,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 2K.
W86-00166

POINT SOURCES-NONPOINT SOURCES TRADING IN THE LAKE DILLON WATERSHED.
Northwest Colorado Council of Governments, Frisco.
Final Report, 1984. 45 p.

Descriptors: *Nonpoint pollution sources, *Point pollution sources, *Trading, *Algae growth, *Advanced wastewater treatment, *Water pollution sources, Phosphorus, Eutrophication, Lake Dillon.

Lake Dillon is a highly valued water supply and recreational resource in north-central Colorado. Changing land uses and development in the basin have produced near-eutrophic algae growth in the lake. All wastewater treatment plants currently employ advanced wastewater treatment for phosphorus removal. Even with zero phosphorus discharge from treatment plants in the future, nonpoint phosphorus sources from growth areas would make the lake eutrophic. A phosphorus control plan for the lake was developed by local governments and adopted by the Colorado Water Quality Control Commission. The plan recommended that advanced wastewater treatment continue to be applied to all point sources. State-of-the-art nonpoint sources controls will be applied by local governments to all new development projects in the basin. An effluent trading system was developed to allow point sources growth beyond 1990. The trading system authorized by the State Commission allows dischargers to receive credit for cleaning up nonpoint sources which existed prior to 1984. A 2:1 ratio is used to account for uncertainties in the process. One pound of credit is assigned for each two pounds of pre-existing nonpoint source phosphorus which is eliminated. This approach should keep phosphorus loading at 1982 levels. It allows local governments to control phosphorus in the most cost-effective manner without being limited only to further reductions on point sources. (Author)
W86-00167

FATE OF CHEMICALLY DISPERSED OIL IN THE SEA: A REPORT ON TWO FIELD EXPERIMENTS,
New Jersey Dept. of Environmental Protection, Trenton.
D. R. Green, J. Buckley, and B. Humphrey.
EPS 4-EC-82-5, December 1982. Environmental Protection Service, Ottawa (Ontario). 125 p, 42 Fig, 16 Tab, 8 Plates, 10 Ref.

Descriptors: *Oil Slicks, *Dispersants, Seawater, Oil Spills, Corexist 9527, Biodegradation.

Three liters of oil were spilled in each of two moored plastic enclosures (CEPEX enclosures) in Saanich Inlet, British Columbia. Corexit 9527 was used to disperse a portion of the surface slick in one enclosure while the other enclosure served as a control. The oil dispersion was stable during the two week period. The average droplet size was micrometer or less. The dispersion of the oil resulted in a rate of biodegradation that is at least an order of magnitude higher than that for undispersed oil. Within 15 days, microbial oxidation of the alkane component of the oil was completed. Only 0.1% of the dispersed oil reached the sediments during the 15 day time period, and this oil was in an advanced state of bacterial decomposition. Loss of volatile components from dispersed oil was slower than from the surface slick. No detectable photochemical oxidation of the dispersed oil or the surface slick occurred during the experiment. Three experimental oil spills of 200, 400, and 200 liters were conducted in October 197 at Royal Roads, British Columbia. The surface slicks were restrained with a Bennett inshore oil boom. The spilled oil was dispersed using Corexit 9527. The highest recorded concentration of dis

persed oil was 1 ppm. After 30 min concentrations of 0.05 ppm were normal, decreasing to background within 5 hr. The dispersed oil did not mix deeper into the water column with time. The integrated quality of oil in the water column decreased more rapidly than either the mean oil concentration of the cloud or the maximum concentration. (Author's abstract, modified).
W86-00172

CHARACTERIZATION OF AEROBIC CHEMICAL PROCESSES IN RESERVOIRS: PROBLEM DESCRIPTION AND MODEL FORMULATION,
Camp, Dresser and McKee, Inc., Annandale, VA.
R. L. Chen, D. Gunnison, and J. M. Brannon.
Technical Report E-83-16, October 1983. Final Report. 87 p, 21 Fig, 9 Tab, 144 Ref.

Descriptors: *Mathematical models, *Dissolved oxygen, *Hydrologic models, *Rate models, Water quality control, Reservoirs, Stratification, Oxidation process, Aerobic conditions, Anaerobic conditions.

This report discusses oxidation pathways of chemicals and important environmental parameters that affect the transformation rate of selected nutrients and metals in lakes and reservoirs, and presents a model for predicting the transition from anaerobic to aerobic conditions. In order to better demonstrate the necessary components for an aerobic predictive model, consideration was given to the basic concepts of the most commonly available equilibrium models for predicting water quality in lakes. Evaluation of the practicality of available models revealed that, although equilibrium models provide the flexible and comprehensive approaches necessary for water quality prediction, rate models are more precise and reliable in their depiction of the transition from anoxic to aerobic conditions in reservoirs. Oxidation rates of selected nutrients and metals in U.S. Army Corps of Engineers reservoirs were determined in environmentally controlled laboratory investigations. Field measurements of the fate of reduced iron and manganese in the anoxic bottom water of Eau Galle Reservoir, Wisconsin, during destratification, corroborated the laboratory results. These oxidation rate coefficients will form the basic input variables for RE-AERS, a reaeration subroutine of the water quality evaluation model CE-QUAL-R1.
W86-00176

COMPUTER MODELING OF HYDRODYNAMICS AND SOLUTE TRANSPORT IN CANALS AND MARINAS: LITERATURE REVIEW AND GUIDELINES FOR FUTURE DEVELOPMENT,
National Board of Waters, Helsinki (Finland).
R. Walton.
Miscellaneous Paper EL-83-5, September 1983. Final Report. U.S. Army Environmental Impact Research Program, Army Engineer Waterways Experiment Station, Vicksburg, MS. 94 p, 45 Fig, 108 Ref.

Descriptors: *Canals, *Marinas, *Hydrodynamics, Computer models, *Solute transport, Mathematical models, Literature review, Design criteria, Water quality, Physical properties, Model studies, Permits.

A literature review of modeling the hydrodynamics and solute transport processes in tidal canals and marinas is presented. Tidal prism analysis and one- and multi-dimensional models are described. By considering the three areas of physical processes, modeling, and design criteria, it is concluded that much still needs to be learned to enable the engineer to design such systems to meet a rational set of design criteria. In evaluating such proposed designs, the permitting agencies are in the same relative state of uncertainty as to what constitutes a good, environmentally acceptable' design. Future direction should include the selection of several varied existing canal and marina sites, and a program to study them to understand the fundamental physics and water quality processes involved. The next step should be to use this information to develop numerical models that can model the important processes observed, and a validation of their formulation. These models should be developed as engineering, as well as scientific, tools to allow easy use by practicing design engineers. A program of selective model and measurement sensitivity should be performed. These criteria should make sense to both the design engineer and the permitting agencies.
W86-00179

DISSOLVED METHANE CONCENTRATIONS IN THE SOUTHEAST BERING SEA, 1980 AND 1981,
Science and Education Administration, Fort Lauderdale, FL. Aquatic Plant Management Lab.
For primary bibliographic entry see Field 2K.
W86-00180

SORPTION BEHAVIOUR OF 14C IN GROUNDWATER/ROCK AND IN GROUNDWATER/CONCRETE ENVIRONMENTS,
Seakem Oceanography Ltd., Sidney (British Columbia).
B. Allard, B. Torstenfelt, and K. Andersson.
Report Prav 4.27, March 1981. 11 p, 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Fate of pollutants, *Water pollution prevention, *Radioactive wastes, *Carbon radioisotopes, *Sorption, Waste disposal, Underground waste disposal, Calcite, Concrete, Groundwater, Carbonates, Chemical precipitation, Moraine, Montmorillonite, Bentonite, Quartz, Granite, Rocks.

The sorption of carbon-14, present in radioactive waste from powerplants and nuclear fuel waste treatment, was studied in batch and column experiments on several solids. Although sorption of C14 was generally low, it increased with increasing calcium content of the solid. The order of increasing sorption on the solids was as follows: granite, sodium montmorillonite, sandy moraine < clayish moraine < bentonite/quartz (10/90) < calcite < concrete, cement paste. Calcite and sandy moraine were the only materials permeable enough for column tests. In experiments with calcite, the retention factor was 3 (C14 transport was up to 3 times slower than water). Higher retention is expected at lower groundwater flow due to the slow kinetics of sorption on calcite. It is expected that the retention factor for concrete and bentonite/quartz would be high enough for use as backfill materials in a radioactive waste repository. No C14 would leak from intact concrete. Even fractured concrete would retain most of the C14 by precipitation of carbonate.
W86-00184

USER GUIDE FOR LARM2: A LONGITUDINAL-VERTICAL, TIME-VARYING HYDRODYNAMIC RESERVOIR MODEL,
Edinger (J.E.) Associates, Inc., Wayne, PA.
E. M. Buchak, and J. E. Edinger.
Instruction Report E-82-3, December 1982. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 91 p, 4 Fig, 4 Ref, 9 Append. Contract/Grant No. DACW39-78-C-0057.

Descriptors: *Fate of pollutants, *Lakes, *Reservoirs, *Water quality, *Model studies, Mathematical models, LARM2 model, Computer models, Hydrodynamics, Dillon Reservoir, Colorado.

LARM2 (laterally averaged reservoir model, version 2) has several improvements over the parent model, LARM. It incorporates a water quality transport module (WQTM) and the capability to add or delete upstream longitudinal segments during flooding or drawdown. This user's guide contains an overview of the model, a summary of its theoretical basis, a description of its application procedure, and an example, the Dillon Reservoir, Colorado. The appendixes include an input data description with examples and user notes for two auxiliary codes. LARM2 can be applied to a single, continuous reach of a river, lake, or reservoir. For $300 computer time, this model can be used for an eight-month simulation at a time step of 15 min for temperature and one other constituent on a grid that is 30 segments by 20 layers with 375 active cells. Estimates do not include intermediate simulations and postprocessing of results.
W86-00190

HYDROCARBONS ASSOCIATED WITH SUSPENDED MATTER IN THE GREEN RIVER, WASHINGTON,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
S. E. Hamilton, and J. D. Cline.
NOAA Technical Memorandum ERL PMEL-30, May 1981. 116 p, 20 Fig, 18 Tab, 1 Ill, 62 Ref, 3 Append.

Descriptors: *Fate of pollutants, *Hydrocarbons, *Rivers, *Suspended solids, *Wastewater treatment, Effluents, Green-Duwamish River, Washington, Aromatic hydrocarbons, Aliphatic hydrocarbons, Vegetation, Outfall, Wastewater outfall, Sediments, Organic compounds.

The suspended hydrocarbon composition in the Green-Duwamish River was defined seasonally and spatially, with special interest in the discharges from the Renton Secondary Treatment Plant. Above Auburn, Washington, the hydrocarbon mixture is dominated by odd-carbon paraffins derived from aquatic and terrestrial plants. In December the C15 and C17 alkanes associated with algae were at the lowest levels of the year. At the sewage outfall the proportion of odd- to even-carbon hydrocarbons decreased, reflecting the increase in even-carbon n-alkanes, pristane, and phytane. Concentrations of total alphatics, total aromatics, and an unresolved complex mixture increased with distance downriver. A hydrocarbon budget calculated for the lower river showed that heavy hydrocarbons were preferentially lost below the sewage outfall. Possible causes for this are (1) flocculation or desorption of suspended hydrocarbons as the effluent mixed with the river water and (2) incomplete recovery of material during analysis. Suspended matter in the river water contained these aromatics: retene, benz(e)pyrene, perylene, benz(g,h,i)perylene, chrysene, and fluoranthene at concentrations of 0.08-2.2 micrograms per gram dry weight. Levels of perylene and benz(g,h,i)perylene in the effluent were about 40 micrograms per gram. Esters of the even-carbon fatty acids associated with wastewater and higher plants were also found in these sediment samples.
W86-00196

WORKING PAPERS PREPARED AS BACKGROUND FOR TESTING FOR EFFECTS OF CHEMICALS ON ECOSYSTEMS.
National Research Council, Washington, DC. Committee to Review Methods for Ecotoxicology.
For primary bibliographic entry see Field 5C.
W86-00230

ECOTOXICOLOGY AT THE WATERSHED LEVEL,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
L. A. Norris.
In: Working Papers Prepared as Background for Testing for Effects of Chemicals on Ecosystems, National Academy Press, Washington, DC. 1981. p 137-148, 9 Ref.

Descriptors: *Ecotoxicology, *Fate of pollutants, *Water pollution effects, *Organic compounds, *Aquatic habitats, Lakes, *Ecosystems, *Toxicology, Watersheds, *Environmental effects, Chemical properties, Heavy metals, Metals, Solubility, Vapor pressure, Stability.

Relatively few toxicological tests on the watershed (ecosystem) level have been done. Traditional techniques emphasize direct effects of chemicals on selected organisms. However, indirect effects are also important and may be far-reaching on the ecosystem level. For example, a chemical which reduces the primary productivity of an ecosystem may not directly affect organisms on higher troph-

ic levels, but the reduction in primary production may have an overwhelming effect. Other factors such as logging or tilling may interact with the chemicals of interest. Baseline values are necessary to determine the effects of natural processes such as carbon fixation by primary producers, energy transfers, nutrient cycling, and decomposition or organic substrates. Watershed pairing is desirable, but few are available for this purpose. Many factors affect the behavior of chemicals in the environment: properties of the chemical (water solubility, equilibrium vapor pressure, partition coefficient, and pH); and environmental properties (climatic, edaphic, topographic, and biotic). Chemicals of particular concern are heavy metals and substances with low water and high fat solubility, high equilibrium vapor pressure, high degree of stability, and high degree of mobility in soil.
W86-00234

UTILITY OF SINGLE SPECIES AND ECOSYSTEM TESTS IN ASSESSING THE ENVIRONMENTAL IMPACT OF RADIONUCLIDE ECOTOXICANTS,
Emory Univ., Atlanta, GA. Dept. of Biology.
H. L. Ragsdale.
In: Working Papers Prepared as Background for Testing for Effects of Chemicals on Ecosystems, National Academy Press, Washington, DC. 1981. p 149-173, 61 Ref.

Descriptors: *Ecotoxicology, *Fate of pollutants, *Water pollution effects, *Radioactive wastes, *Aquatic habitats, *Ecosystems, *Aquatic life, *Environmental effects, *Toxicology, Single species tests, Radioisotopes, Microenvironment.

Single species or microcosm tests have a useful, but limited, role in defining radionuclear impacts on organisms. Some of the uses of single species testing include explaining phenomena observed at the ecosystem level, providing preliminary trials prior to large-scale ecosystem testing, studying in greater detail the specific mechanisms identified from ecosystem testing, developing a baseline of potential impact, developing predictive relationships between dose and response, and analyzing damage mechanisms. Ecosystem testing, however, provides comprehensive and conclusive knowledge of radionuclear ecotoxicant impacts which allows analysis of short-term and long-term impacts, provides data whose transferability to other systems and regions can be evaluated, allows extrapolation with maximum confidence, and allows explicit comparison of the severity of impact from a variety of ecotoxicants.
W86-00235

ECOSYSTEM APPROACH TO THE TOXICOLOGY OF RESIDUE FORMING XENOBIOTIC ORGANIC SUBSTANCES IN THE GREAT LAKES,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
W. R. Swain.
In: Working Papers Prepared as Background for Testing for Effects of Chemicals on Ecosystems, National Academy Press, Washington, DC. 1981. p 193-257, 2 Fig, 18 Tab, 129 Ref.

Descriptors: *Fate of pollutants, *Water pollution effects, *Great Lakes, *Toxicology, *Ecosystems, *Aquatic habitats, *Pesticides, *Organochlorine pesticides, Insecticides, *Chlorinated hydrocarbons, Lakes, DDT, Polychlorinated biphenyls, Dieldrin, Lindane, Methoxychlor, Endosulfan, Benzene hexachloride, Plankton, Sediments, Lake sediments, Aldrin, Endrin, Heptachlor, Chlordane, Phthalates, Fish, Public health, Food chains.

A conceptual framework is presented for an ecosystem approach to the question of the impact of residue forming toxic substances of anthropogenic origin in the Great Lakes. This framework is an attempt to link a definite and orderly progression of events related to input sources of toxic substances and their compartmentalization phenomena. It is believed to be of utility because it considers interrelationships and properties between separate entities, incorporates defined criteria, and utilizes a series of linkages into which quantifiable values and numerically precise data can be inserted to enable an adequate mechanism for understanding the fate, transport and effects of toxic organochlorine compounds. Given the magnitude of the Great Lakes ecosystem in both spatial and temporal scales, the interdependency of the various ecosystem compartments and the multiplicity of exogenous substances with differing chemical/biological reactions, it is difficult to conceive that any other approach to the question could adequately address the complexity of the issue. While short term laboratory tests are useful in delineating areas of the environment where problems can be anticipated, often the question of scale makes direct translation of results to the Great Lakes difficult, if not impossible. The approach described in this effort is an attempt to overcome these difficulties for toxic xenobiotic organochlorine compounds. (Author)
W86-00237

LEACHATE FROM HAZARDOUS WASTES SITES,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
P. N. Cheremisinoff, and K. A. Gigliello.
Technomic Publishing Co., Inc., Lancaster, PA. 1983. 88 p.

Descriptors: *Water pollution sources, *Fate of pollutants, *Leachates, *Landfills, *Water disposal, Solid waste disposal, Sampling, Monitoring, Wells, Model studies, Pollutant identification, Linings, Plastics, Water pollution control, Wastewater treatment, Water pollution effects, Groundwater pollution, Damage.

This report is a guide to the formation, generation, sampling methodology, control, and treatment of leachate from solid waste sites. Four types of disposal sites are defined--dump, landfill, sanitary landfill, and secured landfill. The mechanisms for contamination of groundwater by leachates are described. The processes of infiltration, percolation, evaporation, and transpiration are involved in leachate generation. Leachate characteristics vary from site to site. The volume depends on the soil's absorptive capacity, areal extent, composition, placement, cover material and operation, and amount of recharge water available for infiltration. The water balance method may be used to estimate leachate generation. Sampling considerations and methods are given for seeps, wells, and leachate collection systems. Laboratory methods applicable to leachate assessment include modeling techniques, shake tests, saturation tests, column tests, and field test cells. Effects of leachate on lining materials are summarized. Among leachate control methods are proper selection of waste, control of water movement, control of decay, lining with leachate collection, leachate treatment, natural renovation, incineration, aeration, leachate recycle, and integrated treatment systems. Leachate damage, usually contamination of wells, and case histories are described.
W86-00247

STREAM WATER QUALITY IN THE COAL REGION OF ALABAMA AND GEORGIA,
Northeastern Forest Experiment Station, Broomall, PA.
K. L. Dyer.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-1246363. General Technical Report NE-73, 1982. 109 p, 34 Fig, 65 Tab, 8 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality, *Streams, *Coal mining, Strip mines, Watersheds, Alabama, Georgia, Appalachia, Small watersheds, Forest watersheds.

Water quality data for 58 small streams in 12 counties of Alabama and 3 in Dade County, Georgia, are given for the period July 19, 1977, to August 10, 1979. Twenty of the watersheds were unmined. Thirty-eight of the watersheds had been surface mined, some recently (after 1972) some mined before 1972. Data included are bicarbonate, carbonate, chloride, sulfate, alkalinity, acidity, pH, specific conductance, 16 trace elements, ammonia, nitrate, nitrate plus nitrite, total nitrogen, phosphorus, orthophosphate, water temperature, suspended solids, turbidity, settleable matter, and estimated discharge. The interpretation of the data will be presented in a later report covering nine states in the Appalachian area.
W86-00250

STREAM WATER QUALITY IN THE COAL REGION OF WEST VIRGINIA AND MARYLAND,
Northeastern Forest Experiment Station, Berea, KY.
K. L. Dyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-118182. General Technical Report NE-70, 1982. 215 p, 71 Fig, 131 Tab, 8 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality, *Streams, *Coal mining, Strip mines, Watersheds, West Virginia, Maryland, Appalachia, Small watersheds, Forest watersheds.

Water quality data for 118 small streams in 27 counties of West Virginia and nine streams in two counties of western Maryland are given for the period June 9, 1977, to November 9, 1979. Forty-eight of the watersheds were unmined. Seventy-nine of the watersheds had been surface mined, some recently (after 1972) and some mined before 1972. Data included are bicarbonate, carbonate, chloride, sulfate, alkalinity, acidity, pH, specific conductance, 16 trace elements, ammonia, nitrate, nitrate plus nitrite, total nitrogen, phosphorus, orthophosphate, water temperature, suspended solids, turbidity, settleable matter, and estimated discharge. The interpretation of the data will be presented in a later report covering nine states in the Appalachian area.
W86-00253

ARCTIC MARINE OILSPILL PROGRAM (AMOP) REMOTE SENSING STUDY,
Canada Centre for Remote Sensing, Ottawa (Ontario).
For primary bibliographic entry see Field 7B.
W86-00258

MATHEMATICAL MODEL, SERATRA, FOR SEDIMENT-CONTAMINANT TRANSPORT IN RIVERS AND ITS APPLICATION TO PESTICIDE TRANSPORT IN FOUR MILE AND WOLF CREEKS IN IOWA.
Battelle Pacific Northwest Labs., Richland, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-122671. EPA 600/3-82-045, August 1982. Environmental Research Laboratory, Athens, GA. 56 p, 24 Fig, 1 Tab, 26 Ref. Contract/Grant No. 68-03-2613.

Descriptors: *Fate of pollutants, *Model studies, *Sediment transport, *Pesticides, *Streams, *Water quality, SERATRA model, Degradation, Biodegradation, Volatility, Hydrolysis, Oxidation, Photolysis, Particulate matter, Finite element method, Four Mile Creek, Wolf Creek, Iowa, Mathematical models, Bottom sediment, Alachlor, Sedimentation.

The sediment-contaminant transport model SERATRA was used as an integral part of the Chemical Migration and Risk Assessment Methodology, which simulates migration and fate of a contaminant over the land surface and in receiving streams, to assess potential short- and long-term impact on aquatic biota. SERATRA, an unsteady, two-dimensional (longitudinal and vertical) finite element model, consists of three submodels coupled to include the effects of sediment-contaminant interactions--a sediment transport submodel, a dissolved contaminant transport submodel, and a particulate contaminant (contaminants adsorbed by sediment) transport submodel. The sediment transport submodel simulates transport, deposition, and scouring of three sediment size fractions of cohesive and noncohesive sediments. The dissolved contaminant transport submodel includes mechanisms of contaminant adsorption/desorption and

ntaminant degradation resulting from hydrolysis, dation, photolysis, volatilization, biological ac- ities and radionuclide decay to predict migration dissolved contaminant. The particulate contami- t submodel simulates transport, deposition and uring of contaminants associated with three size ctions of sediments. SERATRA also predicts nges of bed conditions for sediment and partic- te contaminants. (Author)
6-00259

ANNING GUIDE FOR EVALUATING AGRI- LTURAL NONPOINT SOURCE WATER ALITY CONTROLS,
rnell Univ., Ithaca, NY.
primary bibliographic entry see Field 5G.
6-00260

REAM WATER QUALITY IN THE COAL GION OF OHIO,
rtheastern Forest Experiment Station, Broo- l, PA.
L. Dyer.
ilable from the National Technical Information vice, Springfield, VA 22161 as PB83-119495. neral Technical Report NE-75, 1982. 138 p, 46 , 73 Tab, 8 Ref.

criptors: *Fate of pollutants, *Water pollution rces, *Water quality, *Streams, *Coal mining, p mines, Watersheds, Ohio, Appalachia, Small ersheds, Forest watersheds.

ter quality data for 70 small streams in 19 nties of Ohio are given for the period June 1, 7, to October 4, 1979. Nineteen of the water- ds were unmined. Fifty of the watersheds had n surface mined, some recently (after 1972) and e mined before 1972. Data included are bicar- ate, carbonate, chloride, sulfate, alkalinity, ity, pH, specific conductance, 16 trace ele- nts, ammonia, nitrate, nitrate plus nitrite, total ogen, phosphorus, orthophosphate, water tem- ture, suspended solids, turbidity, settleable ter, and estimated discharge. The interpretation he data will be presented in a later report ering nine states in the Appalachian area.
5-00267

REAM WATER QUALITY IN THE COAL GION OF PENNSYLVANIA,
theastern Forest Experiment Station, Broo- , PA.
. Dyer.
ilable from the National Technical Information rice, Springfield, VA 22161 as PB83-124586. eral Technical Report NE-76, 1982. 168 p, 61 88 Tab, 8 Ref.

criptors: *Fate of pollutants, *Water pollution ces, *Water quality, *Streams, *Coal mining, o mines, Watersheds, Pennsylvania, Appalach- mall watersheds, Forest watersheds.

er quality data for 86 small streams in 23 nties of Pennsylvania are given for the period 13, 1977, to October 4, 1979. Twenty-nine of watersheds were unmined. Fifty-seven of the ersheds had been surface mined, some recently r 1972) and some mined before 1972. Data uded are bicarbonate, carbonate, chloride, sul- alkalinity, acidity, pH, specific conductance, race elements, ammonia, nitrate, nitrate plus te, total nitrogen, phosphorus, orthophosphate, er temperature, suspended solids, turbidity, set- le matter, and estimated discharge. The inter- ation of the data will be presented in a later rt covering nine states in the Appalachian
5-00281

RVEY OF POLYCHLORINATED BIPHEN- IN INDUSTRIAL EFFLUENTS IN NADA.
ironmental Protection Service, Ottawa (Ontar- Water Pollution Control Directorate.
ort EPS 3-WP-81-1, March 1981. 19 p, 5 Tab, ef.

Descriptors: *Water pollution sources, *Fate of pollutants, *Polychlorinated biphenyls, *Organic compounds, *Industrial wastewater, Pulp and paper industry, Aluminum, Paint industry, Chemical industry, Chlorinated hydrocarbons, Canada.

Polychlorinated biphenyls (PCBs) in industrial effluents and process streams in Canada were sampled in two phases: (1) an overall survey involving 308 samples in 31 types of industries and (2) sampling of 45 effluents from 7 selected plants discharging significant quantities of PCBs. Of the 308 samples from general industry, 48 contained more than 0.1 ppb PCB. These industries were pulp and paper, smelting, paint manufacturing, electrical equipment manufacturing, chemicals, sewage treatment, aviation, iron and steel, petrochemicals, mining, poultry packing, waste oil recycling, food products, machine shop, and coal superport. A pulp and paper mill using recycled paper discharged effluents with 28.0-48.2 ppb PCB. Other plants and the PCB concentrations (ppb) of their effluents were aluminum smelting, 0.11-3.94; paint manufacturing, 0.24-4.66; petrochemicals, 0.42; and chemical manufacturing, 5.1. Likely sources of PCB in the effluents were recycled waste paper, hydraulic fluids, paint pigments, and electrical oils. PCBs, probably with 4 or less chlorine atoms per molecule, may be formed inadvertently by some plant processes (chlorination of waste biphenyls in wastewater treatment or synthesis from certain aromatic compounds). However, none were detected in this study, which did not use analytical methods designed to detect lower-chlorine PCBs.
W86-00286

USE OF SATELLITE IMAGERY FOR TRACKING THE KURDISTAN OIL SPILL,
Remotec Applications Ltd., St. John's (Newfoundland).
For primary bibliographic entry see Field 7B.
W86-00291

EFFECTS, PATHWAYS, PROCESSES, AND TRANSFORMATION OF PUGET SOUND CONTAMINANTS OF CONCERN,
E.V.S. Consultants Ltd., North Vancouver (British Columbia).
D. E. Konasewich, P. M. Chapman, E. Gerencher, G. Vigers, and N. Treloar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-118208. NOAA Technical Memorandum OMPA-20, July 1982. National Oceanic and Atmospheric Administration, Boulder, CO. 357 p, 35 Fig, 37 Tab, 765 Ref.

Descriptors: *Fate of pollutants, *Water pollution effects, *Estuaries, Sediments, *Toxicity, *Organic compounds, Benthos, *Puget Sound, Chlorinated hydrocarbons, Polyaromatic hydrocarbons, Naphthalene, Benzo(a)anthracene, Fluoranthenes, Benzo(a)pyrene, Arsenic, Cadmium, Heavy metals, DDT, Insecticides, Pesticides, Polychlorinated biphenyls, Hexachlorobenzene, Phthalates, Copper, Lead, Mercury, Selenium, Silver, Aquatic life, Inorganic compounds, Bioaccumulation, Biodegradation, Water pollution sources.

Toxicity and distribution data on the 183 organic compounds and 37 inorganic ions identified in Puget Sound sediments, biota, and waters were reviewed. The chemicals were classified into six categories based on degree of concern for the environment. The 15 contaminants or classes of contaminants of greatest concern were polychlorinated dibenzofurans and chlorophenol precursors, chlorinated butadienes, polyaromatic hydrocarbons and halogenated derivatives, arsenic, cadmium, DDT and metabolites, polychlorinated biphenyls, hexachlorobenzene and related compounds, chlorinated ethylenes, phthalates, copper, lead, mercury, selenium, and silver. The study concluded that concentrations of many contaminants were higher in the Puget Sound ecosystems than in other areas of the world. Four research needs were identified: (1) develop and implement a surveillance plan to assess trends and fate and effects of pollutants (2) develop an ecological hazard assessment scheme, (3) establish the relationship between levels of contaminants in sediments and benthic biota and the consequent toxic effects of these levels on biota, and (4) develop additional basic information on the behavior and fate of chemicals in the marine and estuarine environments.
W86-00293

EUROPEAN AND UNITED STATES CASE STUDIES IN APPLICATION OF THE CREAMS MODEL.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
IIASA Collaborative Proceedings Series CP-82-S11, 1982. Edited by V. Svetlosanov and W. G. Knisel. 148 p.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Sediment yield, Pesticides, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Phosphorus, Nitrogen, Agricultural chemicals, Fertilizers, Leaching, *Mathematical models, CREAMS model.

CREAMS (Chemicals, Runoff, and Erosion from Agricultural Management Systems), a mathematical model for determining nonpoint source pollution, has three components: hydrology, erosion/sedimentation, and chemistry (nutrients and pesticides). Part I describes the model and shows how it is applied. Parts II and III concern case studies in several European countries: Finland, Germany, Poland, Sweden, United Kingdom, and Lithuania (USSR). Part IV looks at the future, CREAMS2, which will incorporate the knowledge obtained in this study. Part V summarizes the basic conclusions. Among the conclusions are (1) CREAMS generally gives good representations of the hydrology, erosion/sediment yield, and chemical processes. It needs revision and addition of certain processes (snowmelt, frozen soil, organic fertilizer, etc.) specific to European conditions. CREAMS is useful for evaluating alternate management alternatives but does not predict absolute quantities. CREAMS should be calibrated when data become available. Although it is a field-scale model, it may be a foundation or a component of regional or larger watershed studies. CREAMS2, an improved and more comprehensive model, will also include soil temperature, snowmelt/frozen soil, nitrogen cycling, vertical flux of pesticides, and a totally linked model structure to simplify process interactions and model feedback.
W86-00294

CREAMS: A SYSTEM FOR EVALUATING MANAGEMENT PRACTICES ON FIELD-SIZE AREAS,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
W. G. Knisel, G. R. Foster, M. H. Frere, R. A. Leonard, and A. D. Nicks.
In: European and United States Case Studies in Application of the CREAM Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 7-40, 5 Fig, 4 Tab, 19 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Sediment yield, Pesticides, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Phosphorus, Nitrogen, Agricultural chemicals, *Mathematical models, Fertilizers, Leaching, CREAMS model.

CREAMS (Chemicals, Runoff, and Erosion from Agricultural Management Systems) is a field-scale mathematical model for assessing nonpoint source pollution and evaluating alternate practices for controlling pollution from sediments and chemicals. CREAMS consists of three major components: hydrology, erosion/sedimentation, and chemistry. The hydrology component estimates storm runoff by either of two options, depending on availability of rainfall data: (1) with daily rainfall data and (2) by an infiltration-based method. The erosion component considers the basic processes of soil detachment, transport, and deposition. The chemistry component concerns plant nutrients and pesticides. An example shows the application

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of CREAMS to a 3.2-acre field in the Georgia Piedmont area.
W86-00295

TESTING THE APPLICATION OF CREAMS TO FINNISH CONDITIONS,
National Board of Waters, Helsinki (Finland).
L. Kauppi.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 43-47, 2 Tab, 3 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Sediment yield, Pesticides, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Phosphorus, Nitrogen, Agricultural chemicals, Fertilizers, Leaching, *Mathematical models, Hovi Basin, *Finland, CREAMS model.

The CREAMS model was applied to the agricultural Hovi basin in Finland. The area under study used the open ditch drainage system. Yearly runoff plus percolation in 1968 was 265 mm (calculated 288 mm) and in 1969 was 223 mm (calculated 229 mm). The daily response lagged by a day because of the ditch system. Soil losses were calculated from the model and from suspended solids concentrations in runoff waters. In 1968 soil loss (in tons per sq km) was 110 (from model) and 14 (from suspended sediments). In 1969 soil loss (in tons per sq km) was 88 (from model) and 24 (from suspended sediments). Nitrogen and phosphorus losses calculated by the model were significantly greater than those calculated from concentrations and runoff observations, particularly in autumn. The model needs modifications to adapt well to Finnish conditions. These considerations include a snowmelt component and further work on calibration and selection of appropriate parameter values.
W86-00296

ENVIRONMENTAL EFFECTS OF NITROGEN FERTILIZATION EXEMPLIFIED BY GROUNDWATER POLLUTION AS SIMULATED BY CREAMS,
Goettingen Univ. (Germany, F.R.).
S. Stemmler.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 49-62, 5 Fig, 3 Tab, 16 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Nitrogen, Agricultural chemicals, *Mathematical models, Fertilizers, Nitrates, Mussum water reserve, Germany, Leaching, CREAMS model.

The CREAMS model was tested in the Mussum water reserve area of northwestern Germany. In the hydrology submodel the first runs underestimated percolation (120-180 mm calculated, 300 mm actual) and overestimated evapotranspiration. Changes in the program and equations produced good results in later runs. Nitrate was the only chemical considered in the study. It was possible to quantify the relation between fertilization intensity (up to 480 kg N per ha) of arable land and nitrate concentrations in the water percolated below the root zone. However, results were applicable only to the thin and uniformly distributed aquifers in the study area.
W86-00297

APPLICATION OF THE CREAMS MODEL FOR CALCULATION OF LEACHING OF NITRATE FROM LIGHT SOILS IN THE NOTEC RIVER VALLEY,
Institute for Land Reclamation and Grassland Farming, Raszyn (Poland).
A. Sapek.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 63-70, 5 Tab, 1 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Nitrates, Nitrogen, Agricultural chemicals, Fertilizers, Leaching, *Mathematical models, Notec River Valley, Poland, CREAMS model, Denitrification.

The CREAMS model was used for calculation of the amount of leached nitrate below the plant root zone and of the nitrogen balance in light soil with average physical properties occurring in the Notec River valley, Poland. The simulation was performed with the precipitation data for the period 1960-1979. The calculated nitrate leaching averaged about 25 kg N per hectare per year, which constitutes a threat for the water quality and fertilizer economy. Higher nitrogen losses from soil were due to the denitrification process. The largest amounts of nitrate leached and percolation occurred in the autumn-winter months. It seems that the most feasible method of verification of the reliability of model output would be the measurement of the content of nitrate in soil after and before the growing season. (Author)
W86-00298

APPLICATION OF THE CREAMS MODEL: WESTERN SKANE, SWEDEN,
Lund Univ. (Sweden). Dept. of Water Resources Engineering.
L. DeMare.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 71-82, 4 Fig, 2 Tab, 11 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Nitrates, Nitrogen, Agricultural chemicals, Fertilizers, Leaching, *Mathematical models, Skane, Sweden, Potatoes, Wheat, CREAMS model.

The hydrology and nutrient components of the CREAMS model were used to evaluate the nitrate leaching from agricultural fields in Skane, at the southern tip of Sweden. Annual leaching amounts corresponded fairly well to results obtained from field experiments. However, CREAMS should not be used to predict absolute quantities. In particular, a small error in estimating percolation in summer causes large errors in leaching output. The model proved useful for comparing nitrate leaching produced from several management practices: potatoes with rain and rain/irrigation; wheat with rain and rain/irrigation.
W86-00299

PREDICTING HILLSLOPE RUNOFF AND EROSION IN THE UNITED KINGDOM: PRELIMINARY TRIALS WITH THE CREAMS MODEL,
National Coll. of Agricultural Engineering, Silsoe (England).
R. P. C. Morgan, and D. D. V. Morgan.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 83-97, 4 Tab, 15 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Sediment yield, *Nonpoint pollution sources, Agricultural hydrology, *Mathematical models, Silsoe, United Kingdom, Runoff, Slopes, CREAMS model.

Promising results are obtained when the CREAMS model is applied to soil losses in the Silsoe area, United Kingdom. Soil loss predictions are reasonable under these conditions: (1) the concept of channel erosion is extended to include convergences of flow within the overland flow whenever sediment concentrations exceed a critical threshold and (2) observed runoff depths from unbounded plots are calculated with the 1-sq m strategy. The hydrology submodel shows promise as a runoff predictor if the observed runoff is calculated with the 10-sq m strategy. The 10-sq m strategy involves converting the observed runoff volumes to an average depth over 10 sq m; the 1-sq m strategy does the same over a 1-sq m area.
W86-00300

APPLICATION OF THE CREAMS MODEL AS PART OF AN OVERALL SYSTEM FOR OPTIMIZING ENVIRONMENTAL MANAGEMENT IN LITHUANIA, USSR: FIRST EXPERIMENTS,
Lithuanian Research Inst. of Forestry, Vilnius (USSR).
L. Kairiukstis, and G. Golubev.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 99-119, 9 Fig, 3 Tab, 5 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Sediment yield, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Phosphorus, Nitrogen, Agricultural chemicals, Fertilizers, Leaching, *Mathematical models, Lithuania, Forests, CREAMS model.

First experiments with the CREAMS model show that it is suitable for predicting hydrology, erosion, and nutrient transport for the conditions in Lithuania. However, it will be necessary to modify the model to compensate for the long, stable snow cover, the high groundwater level, and the processes associated with snowmelt. Although CREAMS was developed for agricultural land, it shows promise for use in forested lands.
W86-00301

REVIEW OF CASE STUDIES OF CREAMS MODEL APPLICATION,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
W. G. Knisel, and V. Svetlosanov.
In: European and United States Case Studies in Application of the CREAMS Model, IIASA Collaborative Proceedings Series CP-82-S11, 1982. p 123-135, 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality control, *Model studies, *Hydrology, *Erosion, *Sediment yield, Pesticides, *Nonpoint pollution sources, Agricultural hydrology, Nutrients, Phosphorus, Nitrogen, Agricultural chemicals, Fertilizers, Leaching, *Mathematical models, Czechoslovakia, Germany, Finland, Lithuania, Poland, Sweden, United Kingdom, CREAMS model.

The applicaton of the CREAMS model in these case studies (Czechoslovakia, Germany, Finland, Lithuania, Poland, Sweden, and United Kingdom) have resulted in identification of model limitations and areas which call for improvements. Also, they have shown that CREAMS gives generally good results, and the model is a tool that can be used to aid in development of agricultural management practices for nonpoint source pollution control. Validation with observed data has shown that CREAMS is a suitable model for extrapolating research results to other climatic and soil regions. Although the model gives reasonable results in simulation, it is desirable to calibrate it with data where possible. (Author)
W86-00302

ETHYLENE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5C.
W86-00303

5C. Effects Of Pollution

RAPIDITY OF RNA SYNTHESIS IN HUMAN CELLS; A HIGHLY SENSITIVE PARAMETER FOR WATER CYTOTOXICITY EVALUATION
Service de Controle des Eaux de la Ville de Paris (France).

primary bibliographic entry see Field 5A.
-00052

TEWATER REUSE AND EXPOSURE TO IONELLA ORGANISMS,
ssah Medical School, Jerusalem (Israel). En-
mental Health Lab.
ttal, H. Bercovier, M. Derai-Cochin, and H.
uval.
r Research, Vol. 19, No. 6, p 693-696, 1985. 1
2 Tab, 19 Ref.

riptors: *Wastewater reuse, *Legionella,
teria, *Public health, Wastewater disposal,
an physiology, Water pollution effects, Fish
s.

t hundred and fifty-two (852) blood sera were
n in 1980 and 1981 from populations residing
agricultural settlements (having a total popu-
of 16,240). These sera were tested for the
nce of antibodies against 15 different antigens
gionella species (L. pneumophila serogroups
nd seven other Legionella, i.e. bozemanii,
anii, micdadei, jordanis, dumoffi, longbea-
and oakridgensis). The results indicate a
icant ($P < 0.02$) excess in the percentage of
positive for L. pneumophila (serogroups 1-8)
g sewage and non-sewage irrigation and fish
workers as compared to the control group
vs 1.5%). For the other Legionella species,
was no difference among the above groups.
solation of L. pneumophila serogroup 4 and
rganisms resembling Legionella spp from one
tion pond used for irrigation strengthens the
pidemiological findings. (Author's abstract)
00054

SAGE OF SELECTED HEAVY METALS M SPHAEROTILUS (BACTERIA: CHLA-OBACTERIALES) TO PARAMECIUM DATUM (PROTOZOA: CILIATA),
le Tennessee State Univ., Murfreesboro.
ansouri-Aliabadi, and R. E. Sharp.
r Research, Vol. 19, No. 6, p 697-699, 1985. 2
18 Ref.

riptors: *Heavy metals, *Sphaerotilus, *Para-
m, *Bacteria, *Bioconcentration, Metals,
zoa, Bioaccumulation, Zinc, Lead, Manga-
Nickel, Water pollution effects.

ability of ciliates to purify turbid activated-
e effluents has been suggested to be the result
edation upon bacteria and flocculation of
and non-living suspended matter. One factor
n brings about the absence or reduction in
er of ciliated protozoa in activated sludge is
troduction of toxic metals, often as by-prod-
of industrial processes. The possibility that
ge of heavy metals occurs from bacteria to
zoa was investigated. Paramecium caudatum
zoans were freed from their associated bacte-
d thrived on Sphaerotilus, a bacterium occur-
n polluted waters, as their only food source.
rotilus was found to take up Zn, Pb, Ni and
metal-containing cultures of this bacterium
employed to feed P. caudatum, and analytical
s revealed the accumulation of Zn, Pb and
he bacteria did not pass Mn to the animals at
en though uptake of Mn by Spaerotilus was
ely high when compared with other metals
n this study. No metals were found in control
es of paramecia. Since Sphaerotilus was the
food source for paramecia during this study,
esults indicate that trace amounts of metals
passed from bacteria to protozoa in a preda-
ey relationship. (Collier-IVI)
00055

VY METAL ACCUMULATION (CD, CU, AND ZN) BY SMELT (OSMERUS DAX) FROM THE NORTH SHORE OF ST LAWRENCE ESTUARY (ACCUMULA-I DE QUELQUES METAUX LOURDS (CD, B ET ZN) CHEZ L'EPERLAN (OSMERUS DAX) PRELEVE SUR LA RIVE NORD DE TUAIRE DU SAINT-LAURENT),
ec Univ., Rimouski. Dept. of Oceanography.
rnac, and C. Lassus.
Water Research, Vol. 19, No. 6, p 725-734, 1985. 4 Fig, 3 Tab, 29 Ref.

Descriptors: *Heavy metals, *Bioaccumulation, *Smelt, *Fish, *St. Lawrence Estuary, *Cadmium, *Copper, *Zinc, *Lead, Metals, Fish physiology, Water pollution effects, Animal tissues, Animal physiology.

A method of physiologically removing metals in marine organisms is by storage in a particular tissue. Several different sites for storing metals were investigated and concentrations of Cd, Cu, Pb and Zn were examined in muscle, liver and gonads of smelt (Osmerus mordax) from the North shore of the St. Lawrence estuary. A modified wet digestion procedure was used to prepare biological samples for the determination of trace elements by flameless atomic absorption spectrophotometry procedure, using calibration standards made up in a matrix of similar acidity. NBS bovine liver reference material was analyzed along with the samples; results were within the specified tolerance. Analyses were reported on a dry weight basis. Copper (range 0.3-3.3 micro-g/g) and zinc (range 19-38 micro-g/g) in muscle fillets were found to be negatively correlated with total body weight. Livers and gonads contained greater levels of the four metals than somatic muscle. Liver metal concentrations of Zn (range 29-108 micro-g/g) and Cd (range 0.06-0.37 micro-g/g) increased with total body weight. All equations fit data at $P < 0.01$. Positive correlations between size and metal concentrations suggest that net uptake may occur. Increasing metal concentrations in liver may represent storage of sequestered products in that organ. In the gonads, no significant relationship exists between total body weight and trace metal contents. Females had significantly greater Cu and Zn concentrations, but no significant difference existed between males and females for Cd concentrations. The relation between concentration and total body weight appears to be specific as to the species, tissues analyzed and environmental conditions. The comparison of metal concentrations in fish to assess variations in contamination levels requires understanding the relationship between metal concentration and body size within each population. (Collier-IVI)
W86-00059

TOXICITY TO DAPHNIA OF THE END PRODUCTS OF WET OXIDATION OF PHENOL AND SUBSTITUTED PHENOLS,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5D.
W86-00064

WATER-QUALITY APPRAISAL, MAMMOTH CREEK AND HOT CREEK, MONO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-00106

PRELIMINARY EVALUATION OF LAKE SUSCEPTIBILITY TO WATER-QUALITY DEGRADATION BY RECREATIONAL USE, ALPINE LAKES WILDERNESS AREA, WASHINGTON,
Geological Survey, Seattle, WA. Water Resources Div.
R. J. Gilliom, P. Dethier, S. A. Safioles, and P. L. Heller.
USGS Water-Resources Investigation Open-File Report 80-1124, 1980. 1 p, (map and text), 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Water quality, *Water pollution control, *Recreation planning, *Wilderness lakes, *Land use, Nutrients, Phosphorus, Pathogens, Maps, *Washington, Alpine Lakes Wilderness Area, *Alpine Lakes.

The relative susceptibility of lakes in the Alpine Lakes Wilderness Area to water-quality degradation was evaluated from two perspectives: (1) water-quality sensitivity, which is the tendency of a lake's water quality to degrade in response to pollutant loading, and (2) pollutant-loading likelihood, which is determined by the presence of drainage-basin features that enhance the transport of pollutants to a lake. Water-quality sensitivity was evaluated for 60 lakes, using a mass-balance phosphorus model to predict the response of each lake to a hypothetical 'worst-case' increase in phosphorus loading. This evaluation suggested that lakes in the Alpine Lakes Wilderness Area generally are not sensitive to foreseeable increases in phosphorus loading because of their high rate of dilution and flushing. Pollutant-loading likelihood was evaluated according to the amount of seasonal 'wet area' near a lake and in the drainage basin. Of 298 lakes evaluated for pollutant-loading likelihood, 74 lakes were rated moderate to high. On the basis of these findings, lakes in the Alpine Lakes Wilderness Area are generally not considered susceptible to long-term degradation as a result of recreational use, but some lakes are probably susceptible to temporary local pollution. The nature of this potential problem, and knowledge of natural features of the Alpine Lakes Wilderness Area, suggest an approach for managing recreation so that the risk of water-quality degradation is minimized. (USGS)
W86-00114

RESULTS OF AN ADAPTIVE ENVIRONMENTAL ASSESSMENT MODELING WORKSHOP-CONCERNING POTENTIAL IMPACTS OF DRILLING MUDS AND CUTTINGS ON THE MARINE ENVIRONMENT,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
G. T. Auble, A. K. Andrews, R. A. Ellison, D. B. Hamilton, and R. A. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-114165. Environmental Research Laboratory, Gulf Breeze, FL. EPA-600/9-82-019. October 1982. 64 p. 33 Fig, 6 Tab, 14 Ref, 1 Append. Contract/Grant No. EPA-81-D-X0581.

Descriptors: *Drilling fluids, *Environmental effects, *Marine environment, Drilling cuttings, Bays, Drilling, Drilling mud, Gulf of Mexico.

This publication summarizes the findings of a workshop held September 14-18, 1981 between the United States Environmental Protection Agency and the United States Fish and Wildlife Service. Discussions focused on information pertaining to fate and effects, identification of general relationships between drilling mud fluids and the marine environment, and identification of site-specific variables likely to determine impacts of drilling muds and cuttings in various marine sites. The workshop was structured around the construction of a model simulating fate and effects of discharges from a single rig into open waters of the Gulf of Mexico. Factors that might produce different fate and effects in enclosed areas such as bays and estuaries also were discussed. Considerable knowledge (such as that concerning fate and physical effects of dredge spoil) that could be effectively employed in analysis of potential fate and physical effects in enclosed areas was identified.
W86-00147

LABORATORY PROTOCOLS FOR EVALUATING THE FATE OF ORGANIC CHEMICALS IN AIR AND WATER,
SRI International, Menlo Park, CA.
For primary bibliographic entry see Field 5A.
W86-00154

LONG-TERM IMPACT OF DREDGED MATERIAL AT TWO OPEN-WATER SITES: LAKE ERIE AND ELLIOT BAY; EVALUATIVE SUMMARY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
H. E. Tatem.
Technical Report D-84-5, November 1984. Final Report. 37 p, 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Dredging, *Lake Erie, *Water pollution effects, *Solid waste disposal, *Ecological ef-

fects, Polychlorinated biphenyls, Microorganisms, Mollusks, Polychaetes, Benthos, Waste disposal, Water pollution.

Dredged material disposal sites in Lake Erie and Elliott Bay were studied in 1979-1980 and results were compared with those obtained in 1975-1976 from studies at the same sites. The Lake Erie disposal sites contained more gravel and sand than control areas. In general the microfaunal animals were less abundant at the Lake Erie disposal sites which were richer in meiofauna. No differences in Hg or Cd levels were found between disposal and control sites. The disposal mound created in 1975-1976 in Elliott Bay had stabilized physically and chemically. The mound area contained more animals than the surrounding bottom areas. Bivalves and polychaetes were the dominant animals found at the Elliott Bay disposal site. Some animals taken from the disposal mound contained polychlorinated biphenyls at levels slightly higher than sediment levels which were in the 2.0- to 3.0-ppm range.
W86-00160

LONG-TERM IMPACT OF DREDGED MATERIAL DISPOSAL IN LAKE ERIE OFF ASHTABULA, OHIO,
Weston (Roy F.), Inc., West Chester, PA.
K. J. Salamon.
Technical Report D-84-3, September 1984. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. 123 p, 41 Fig, 15 Tab, 40 Ref, 6 Append. Contract/Grant No. DACW39-79-C-0060.

Descriptors: *Dredging, *Sediment disposal, *Sediments, *Benthic fauna, *Ecological effects, *Heavy metals, Benthos, Aquatic animals, Mercury, Cadmium, *Dredging spoil, Bioaccumulation, Silt, Sand.

Animal, sediment, and water samples obtained from three Lake Erie disposal sites containing material dredged from Ashtabula Harbor were analyzed for sediment characteristics, benthic animals and Hg and Cd levels. Results were compared with those of two nearby reference areas and with results of studies conducted in 1975 and 1976. Disposal sites contained more gravel and sand than the reference sites which were predominantly silt and clay. A number of macrofauna and meiofauna benthic animals were found at both disposal and reference areas. In general, more macrofaunal animals and a greater variety of species were found at the reference areas. Only the macrofauna were statistically more abundant at the reference areas. Sediment analyses showed the reference or control areas contained higher levels of Hg compared to the disposal areas. For Cd the opposite was true. There were higher Cd levels at the disposal areas. The differences in metal concentrations at disposal and reference sites were not statistically significant. Tissue analyses showed that animals at the reference areas contained higher levels of Hg and Cd compared to disposal area animals.
W86-00162

VOLUNTEER LAKE MONITORING, 1981,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
D. F. Sefton, and J. R. Little.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119180. Report No. IEPA/WPC/82-006, June 1982. 138 p, 20 Fig, 6 Tab, 28 Ref, 4 Append.

Descriptors: *Lakes, *Water pollution effects, *Monitoring, *Limnology, *Transparency, *Water quality, Illinois, Eutrophication, Stratification, Thermal stratification, Trophic level, Data acquisition, Glacial lakes, Lake morphology, Reservoirs, Lake classification, Aquatic life, Aquatic plants, Aquatic animals, Algae, Ecosystems, Food chains, Photosynthesis, Respiration, Lake stages, Water pollution sources, Water quality control, Septic tanks.

This report summarizes the methods and results of the Illinois EPA 1981 volunteer lake monitoring program. Secchi disc transparency, total depth, and field observations were recorded by 141 volunteers monitoring 87 lakes. Lakes ranged in transparency from 137.9 inches (Arbor in DuPage County) to 7.3 inches (Royal in Calhoun County). The clearest lakes were generally in the northwestern and southern part of the state; the most turbid, in the central and southcentral regions. Average transparencies of less than 4 ft (minimum recommended for bathing beaches) were reported in 63 of the 87 lakes. About 1/3 of the lakes had average values less than 2 ft, indicating use impairment problems. None of the monitored lakes were classified oligotrophic, 9 were mesotrophic, and the remainder were eutrophic. A primer of basic information on Illinois lakes for the layman is given. This includes origin, shape, hydrology, ecosystems, thermal stratification, succession and eutrophication, pollution, and water quality control measures.
W86-00200

METHODS FOR ECOLOGICAL TOXICOLOGY: A CRITICAL REVIEW OF LABORATORY MULTISPECIES TESTS.
Oak Ridge National Lab., TN. Environmental Sciences Div.
Ann Arbor Science, Ann Arbor, MI. 1981. Edited by Anna S. Hammons. 307 p.

Descriptors: *Water pollution effects, *Toxicology, *Chemical wastes, Ecological effects, Environmental effects, Aquatic habitats, Aquatic plants, Algae, Predation, Fish, Sediments, Zooplankton, Parasites, Population dynamics, Ecosystems, Mathematical models, Model studies, Invertebrates, Predation, Microorganisms, Arthropods, Insects, Soil, Litter, Animals, Plants, Mycorrhizae.

Selected laboratory methods for measuring ecological effects of toxic substances were critically evaluated. Criteria used in the evaluation were whether or not the tests were rapid, reproducible, relatively inexpensive, unequivocal, sensitive, socially relevant, predictive, generalizable, and well-developed. Tests recommended for research and development were as follows: in aquatic test systems--zooplankton-zooplankton predation tests, fish-zooplankton predation tests, parasitism, zooplankton-algal grazing tests, pelagic microcosms, and model streams; in terrestrial test systems--population interactions and ecosystems; and mathematical models--ecosystem paramater handbook, model validation methods, theoretical studies (multipopulation models, loop analysis, input-ouput analysis).
W86-00210

SURVEY OF NATIONAL AND STATE REGULATORY AGENCY POLICY AND PROCEDURES FOR THE DETERMINATION OF THE TOXICITY OF WASTEWATER EFFLUENTS.
Ecological Analysts, Inc., Sparks, MD.
For primary bibliographic entry see Field 6E.
W86-00211

LONG-TERM ECOLOGICAL BEHAVIOUR OF ABANDONED URANIUM MILL TAILINGS; 2.: GROWTH PATTERNS OF INDIGENOUS VEGETATION ON TERRESTRIAL AND SEMI-AQUATIC AREAS,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
K. Kalin.
Report EPS 3/HA/2, December 1984. 98 p, 29 Fig, 17 Tab, 62 Ref.

Descriptors: *Water pollution effects, *Mine wastes, *Vegetation, *Uranium mill tailings, Spoil banks, Industrial wastes, Acid mine drainage, Trees, Cattails, Aquatic plants, Growth, Wetlands, Plant populations, Aspen trees, Birch trees.

The effect of abandoned or inactive uranium mill tailings on natural vegetation was studied in Ontario. Cattails have invaded the semi-aquatic areas. All communities were essentially monocultures of Typha latifolia, T. angustifolia, or T. glauca. Sedges, wool grass, and reed grass were found in transition zones between the cattails and the dry tailings. Cattail growth appeared to depend on the hydrological conditions, rather than on the chemical nature of the tailings. The root zones were less acidic than the soil surface. Decomposition coefficients of the cattail stands were comparable to those in control stands. Trees, mainly trembling aspens and white birch, have colonized the uranium tailings. Tree heights were similar regardless of site treatment (fertilizer and limestone application). However, when compared with trees in control sites, the trees appeared stunted and growing at their limits of ecological tolerance.
W86-00217

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN: ECONOMIC AND SOCIAL IMPACTS OF GROUNDWATER CONTAMINATION; A CASE STUDY IN EAST BAY TOWNSHIP, GRAND TRAVERSE COUNTY, MICHIGAN.
Northwest Michigan Regional Planning and Development Commission, Traverse City.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-132670. MI/DNR/GW-82/07, June 1982. 22 p. EPA Grant P00558801.

Descriptors: *Water pollution effects, *Groundwater pollution, *Water quality, *Water supply, Social impact, Economic impact, East Bay Township, Grand Traverse County, Michigan, Municipal water, Groundwater management, Local governments, Organic compounds, Attitudes, Public opinion, Water costs, Wells.

The social and economic impacts of groundwater contamination in East Bay Township, Grand Traverse County, Michigan, were surveyed in the Avenue E area where city water service was extended to potentially 102 homes. Contamination consisted of several toxic chemicals, which produced strong odor and foaming in the water supply. Most residents were retired or older working persons for whom additional expenses could significantly impact their budgets. The residents' perceptions of and reactions to their well water contamination were closely associated with what they could see or understand about water quality. All residents coped with the problems with varying degrees of hardship. The largest economic factor was the city water hookup. However, most residents had enough funds set aside for such an emergency. The contamination affected property values, a fact that most residents did not perceive. The most common social impact was lack of water. Other social impacts were frustration over the lack of information and over the water rate negotiations. All residents wanted the responsibility for the contamination resolved as a step toward cost reimbursement. In general the property owners' confidence in the government agencies involved in the problem did not diminish. The township government incurred costs of $13,200 the additional work was a major burden for the small staff.
W86-00218

WORKING PAPERS PREPARED AS BACKGROUND FOR TESTING FOR EFFECTS OF CHEMICALS ON ECOSYSTEMS.
National Research Council, Washington, DC. Committee to Review Methods for Ecotoxicology.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-132811. National Academy Press, Washington, DC. 1981. 257 p.

Descriptors: *Water pollution effects, *Fate of pollutants, Lakes, *Ecosystems, Toxicology, *Aquatic habitats, *Aquatic animals, *Environmental effects, Microenvironment, *Toxic wastes, *Ecotoxicology.

The eleven working papers in this volume were prepared for the study of the committee to Review Methods for Ecotoxicology. The charge to the Committee was to identify characteristics of ecological systems that would indicate hazardous effects of chemicals beyond the level of single species, to establish criteria for suitable testing schemes, and to evaluate the effectiveness of available test systems in assessing effects of chemicals within ecosystems. To assist in its deliberations

broad range of issues to be addressed, the nmittee sought additional input from a number experts. The working papers address a variety topics: the use of microcosms as a testing eme in terrestrial and aquatic systems; lethal e distribution and diatoms as monitoring tech- ues for hazard assessment of chemicals in eco- ems; special problems associated with hazard ssment of wetlands and watersheds; approach- o assessing the environmental impact of radio- lide and xenobiotic organic substances; a gener- eview of ecosystem properties relevent to eco- cology; and a discussion of the advantages and dvantages of various classes of ecological tests. thor)
6-00230

KES AND MICROCOSMS: EXTENDING MI- OCOSM DATA TO AQUATIC ECOSYS- MS,
ifornia Univ., Berkeley. Lawrence Berkeley
I. Gleick.
Working Papers Prepared as Background for ting for Effects of Chemicals on Ecosystems, ional Academy Press, Washington, DC. 1981. p 9, 76 Ref.

criptors: *Water pollution effects, *Lakes, uatic habitats, *Ecosystems, *Microcosms, uatic animals, Temperature, Nutrients, Fish, kton, Water quality, Transparency, Phospho- Biomass, Turbidity, Fish food, Phytoplankton, ae, Oxygen depletion, Predation, *Microenvir- ent.

rocosms can be used to determine the effects of c materials on aquatic ecosystems. One limita- of microcosms is the difficulty in accurately deling certain important ecosystem parameters as fish productivity, water transparency, r, and disease vectors. These macrovariables often influenced by microvariables (tempera- , composition and productivity of plankton munities, water composition, and microbial de- position activity). By analyzing in microcosms effects of perturbations on microvariables, and using field data on the correlations between e micro- and macrovariables, it is possible to uce data on how a macrovariable may react to ven environmental perturbation. Among the t promising correlations are phosphorus levels fish yields and transparency, total dissolved ls with standing crop of fish, and chemical centration (e.g., ammonia) levels with oxygen etion and fish kills.
5-00231

TIMUM MICROCOSMS FOR LAKE ECO- XICOLOGY,
fornia Univ., Berkeley. Lawrence Berkeley
arte.
Working Papers Prepared as Background for ing for Effects of Chemicals on Ecosystems, onal Academy Press, Washington, DC. 1981. p 9, 16 Ref.

criptors: *Water pollution effects, *Lakes, uatic habitats, *Ecosystems, *Microcosms, uatic animals, *Toxicology, Gnotobiotic initi- n, Whole-water-sample initiation, Surface vth, Biomass, Turbidity, Fish food, Phyto- kton, Algae, Oxygen depletion, Predation, toxicology, Microenvironment.

y options are available for the design, initi- n, and operation of lake-like microcosms. The ces selected will have a large influence on the sm of the results of ecotoxicological studies ducted with these microcosm. Hydraulically ed systems, initiated by the whole-water- ple method, and periodically poured into clean ainers to prevent surface growth will behave t like the parent lake with respect to both nical and biotic parameters. It is also likely that systems will provide the most realistic infor- on about the pathways and effects of toxic tances. Replicability is often poor when orga- s are initially present in small numbers. Gener- no added replicability or realism is obtained by increasing the complexity and expense of the microcosm. For example, whole-water-sample initiation is easier than gnotobiotic initiation, closed systems are simpler than chemostats, and surface growth control by periodic pouring is easier than other means. However, this does not apply to incorporation of a benthic compartment in a microcosm.
W86-00232

CHEMICALS AND WETLANDS,
R. H. Kadlec.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-132811. In: Working Papers Prepared as Background for Testing for Effects of Chemicals on Ecosystems, National Academy Press, Washington, DC. 1981. p 97-118, 42 Ref.

Descriptors: *Fate of pollutants, *Wastewater treatment, *Wetlands, *Chemicals, *Aquatic habitats, Water quality, Advanced wastewater treatment, Microbial degradation, Biodegradation, Biological wastewater treatment, Buffering, Nutrients, Nitrogen, Phosphorus, Aquatic plants, Heavy metals, Bottom sediments, Organic compounds, Halogenated hydrocarbons, Hydrocarbons, Biochemical oxygen demand, Chemical oxygen demand, Pathogens, Bacteria, Coliforms, Viruses.

Wetlands have certain characteristics which must be considered during an environmental assessment of toxic chemicals on the ecosystem. Wetlands appear to have a buffering systems (with respect to pH, alkalinity, and hardness), which tends to maintain a stationary operating point under natural and man-made stress. Water quality varies with time (diurnal, seasonal, historical) and water flow distance. The hydrologic regime must be fully understood the understand the variation of chemical parameters. Sediment is the site of action for most uptakes and initial storages of chemicals. Uptake by plants and subsequent return to the sediment often takes many months, while epiphytes perform similarly, but on a time scale of hours. Nitrogen and phosphorus show a cyclic behavior, and microbial processes are very important in nutrient uptake processes. Heavy metals are absorbed aquatic plants and sediments, with more entering the sediments in most wetlands. Refractory chemicals such as hydrocarbons or halogenated hydrocarbons are often slowly degraded by microbial processes. Advanced wastewater treatment using wetlands usually has excellent BOD and COD reduction. The fate of viruses and bacteria in wastewater applied to wetlands has been studied with variable results.
W86-00233

ECOTOXICOLOGY AT THE WATERSHED LEVEL,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
For primary bibliographic entry see Field 5B.
W86-00234

UTILITY OF SINGLE SPECIES AND ECOSYSTEM TESTS IN ASSESSING THE ENVIRONMENTAL IMPACT OF RADIONUCLIDE ECOTOXICANTS,
Emory Univ., Atlanta, GA. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W86-00235

CLASSES OF ECOTOXICOLOGICAL TESTS: THEIR ADVANTAGES AND DISADVANTAGES FOR REGULATION,
California Univ., Berkeley. Lawrence Berkeley Lab.
R. A. Schneider.
In: Working Papers Prepared as Background for Testing for Effects of Chemicals on Ecosystems, National Academy Press, Washington, DC. 1981. p 175-191, 24 Ref.

Descriptors: *Water pollution effects, *Aquatic habitats, *Microcosms, *Ecosystems, *Toxicology, Single species tests, *Environmental effects, Field tests, *Ecotoxicology, Microenvironment,.

Three classes of ecotoxicological tests, single-species, microcosm, and field tests, are discussed and evaluated for their usefulness in toxic substance regulation. Criteria for evaluation are ability to predict ecosystem-level effects, replicability, standardizability, speed, simplicity, and cost. The major conclusion is that microcosms of intermediate complexity and small field plots are presently the most useful tools for ecotoxicological testing and hazard evaluation. (Author)
W86-00236

ECOSYSTEM APPROACH TO THE TOXICOLOGY OF RESIDUE FORMING XENOBIOTIC ORGANIC SUBSTANCES IN THE GREAT LAKES,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
For primary bibliographic entry see Field 5B.
W86-00237

RESTORATION OF HABITATS IMPACTED BY OIL SPILLS.
Butterworth, Boston. 1984. Edited by John Cairns, Jr. and Arthur L. Buikema, Jr. 182 p.

Descriptors: *Oil spills, *Ecological effects, *Oil pollution, Symposium, *Water pollution effects, *Water pollution control, *Cleanup operations, Tidal flats, Salt marshes, Coral reefs, Mangrove swamps, Beaches, Shores, Sea grasses, Tundra, Habitats, Fisheries, Environmental impact statement, Conferences, Ecosystems.

This book presents reports of a workshop held at the Virginia Polytechnic Institute and State University on November 9-11, 1981. The workshop convened scientists from various backgrounds to review the problem of oil spills and determine courses of action that may include possible means for restoration of impacted habitats. Seven chapters authored by different scientists cover the following topics: recovery and restoration of rocky shores, sandy beaches, tidal flats, and shallow subtidal bottoms impacted by oil spills; the effects of oil on seagrass ecosystems; the recovery and restoration of salt marshes and mangroves following an oil spill; measurements of damage, recovery, and rehabilitation of coral reefs exposed to oil; oil spill damage and recovery in tundra and taiga; fisheries resource impacts from spills of oil or hazardous subtances; and a workshop summary.
W86-00239

RECOVERY AND RESTORATION OF ROCKY SHORES, SANDY BEACHES, TIDAL FLATS, AND SHALLOW SUBTIDAL BOTTOMS IMPACTED BY OIL SPILLS,
Stockholm Univ. (Sweden). Dept. of Zoology.
B. Ganning, D. J. Reish, and D. Straughan.
In: Restoration of Habitats Impacted by Oil Spills, Butterworth, Boston. 1984. Edited by John Cairns, Jr. and Arthur L. Buikema, Jr., p 7-36, 5 Fig, 5 Tab, 96 Ref.

Descriptors: *Oil spills, *Oil pollution, *Cleanup operations, *Ecological effects, *Literature reviews, *Water pollution effects, Aquatic organisms, *Littoral environments, Tidal flats, Shores, Environmental effects, Intertidal areas, Beaches.

A review of the literature on oil spills on rocky shores shows that the intertidal organisms in this type of environment exhibit considerable tolerance to oil pollution. Most damage from oil coating leads to suffocation or loss of attachment to the substrate. On sandy intertidal shores of tidal flats, the impact is increased by the persistence of oil in unconsolidated substrates. In subtidal sediment bottoms, the sensitivity to oil pollution is greater than in shallow sediment habitats since the organisms are living in fairly stable environments. Oil spill impact and effects of cleanup operations are more closely related to seawater temperatures than to latitude. Areas with large tidal amplitude suffer less from oil pollution than do low tidal or nontidal areas. Seasonality affects the impact of oil spills, especially when the spill takes place after reproduction and hatching. Areas having salinities dif-

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fering from those of normal seawater suffer more stress when subjected to oil pollution due to increased inherent physiological stresses. For rocky shores, cleanup of oils by natural recovery processes is usually recommended. If mechanical removal of oil-contaminated sand is not feasible, then the polluted area should be left to natural recovery methods. Disposal of materials from cleanup operations is best done at oil refineries.
W86-00240

EFFECTS OF OIL ON SEAGRASS ECOSYSTEMS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. C. Zieman, R. Orth, R. C. Phillips, G. Thayer, and A. Thorhaug.
In: Restoration of Habitats Impacted by Oil Spills, Butterworth, Boston. 1984. Edited by John Cairns, Jr. and Arthur L. Buikema, Jr., p 37-64, 5 Fig, 1 Tab, 82 Ref.

Descriptors: *Sea grasses, *Aquatic plants, *Ecosystems, *Oil spills, *Oil pollution, *Ecological effects, *Water pollution effects, *Cleanup operations, Fouling, Littoral zones, Environmental effects, Habitats, Dispersants, Toxicity, Intertidal areas, Literature reviews.

A review of seagrass ecology is given to facilitate a discussion of the effects of oil spills on one of the most productive ecosystems known. Physically, seagrasses prevent erosion and stabilize the effects of tidal actions and provide habitats for numerous epiphytic organisms. Biologically, seagrasses perform an essential cycling of nutrients by absorbing P through the roots and leaves and returning both N and P to the water column from sediments via the plant. Seagrass ecosystems can be damaged by oil through direct suffocation or fouling of organisms or destruction of food sources or habitats. Oil pollution can affect the food market value of seagrass fisheries by tainting of flavor. Studies in the literature of major oil spills indicate that the greatest damage to aquatic organisms seems to be from aromatic hydrocarbon fractions of oil. The effects of oil dispersants on seagrass communities are not known. Inert absorbents present little hazard to seagrass systems if properly used. The normal recovery of seagrass systems from oiling depends on the extent of damage to sediments. Efforts of restoring oil-damaged seagrass systems by transplanting plugs or shoots have met with variable success. It is suggested that research be carried out on the toxicity levels of the major hydrocarbon substances on the major seagrass species in laboratory and field tests.
W86-00241

RECOVERY AND RESTORATION OF SALT MARSHES AND MANGROVES FOLLOWING AN OIL SPILL,
Research Planning Inst., Inc., Columbia, SC.
C. D. Getter, G. Cintron, B. Dicks, R. R. Lewis, and E. D. Seneca.
In: Restoration of Habitats Impacted by Oil Spills, Butterworth, Boston. 1984. Edited by John Cairns, Jr. and Arthur L. Buikema, Jr., p 65-113, 7 Fig, 4 Tab, 121 Ref.

Descriptors: *Mangrove swamps, *Marshes, *Oil spills, *Oil pollution, *Ecological effects, *Water pollution effects, *Cleanup operations, *Literature reviews, Wetlands, Dispersants, Ecosystems, Marsh plants, Swamps, Environmental effects.

Oil impacts to marshes will vary with amount of oil spilled, oil type, magnitude of cleanup activities, physical and biological structure of the marsh, latitude and season. Persistence of damage and recovery of the system depend on physical, chemical, and biotic factors such as weathering rate and degree of oil removal, availability of propagules, successional processes, sediment erosion/accretion, and restorative activities by man. Mangrove forests have different reactions to oil pollution, depending on mangrove types. Basin forests are already subjected to high natural stresses and may be more sensitive to additional stresses. If mangrove overwash islands are isolated from normal waves, they can be more severely damaged by the stranding of oil in them. Most protective techniques are unlikely to damage marsh ecosystems, but the effects of oil-dispersant mixtures are not known. Foot and equipment traffic during cleanup of oil spills may produce adverse effects on marshes but not usually on mangroves. Techniques for restoring oiled marsh and mangrove areas include transplanting, fertilization, direct seeding, planting of propagules, seedlings or small trees. Research gaps include the effects of dispersants and herding compounds on marshes and mangroves, evaluation of cleanup techniques, studies on animal species of marshes and mangroves, follow-up studies of spill sites, growth of plants on oiled substrates and experimental restoration techniques.
W86-00242

MEASUREMENTS OF DAMAGE, RECOVERY, AND REHABILITATION OF CORAL REEFS EXPOSED TO OIL,
Continental Shelf Associates, Inc., Boulder, CO.
K. W. Fucik, T. J. Bright, and K. S. Goodman.
In: Restoration of Habitats Impacted by Oil Spills, Butterworth, Boston. 1984. Edited by John Cairns, Jr. and Arthur L. Buikema, Jr., p 115-133, 3 Fig, 2 Tab, 62 Ref.

Descriptors: *Coral reefs, *Oil spills, *Corals, *Oil pollution, *Dispersants, *Water pollution effects, *Ecological effects, *Cleanup operations, Environmental effects, Coelenterates, Oil recovery, Ecosystems, Oil.

The Arabian Gulf and the Greater Caribbean are two well developed coral reef areas that receive much petroleum activity through the traffic of oil transporting tankers. Prespill mapping of coral reefs, a technique useful in the prevention and cleanup of oil spills, has been applied only to some reef areas. The sensitivity of reef ecosystems to oil spills is increased if the reef is of the emergent of shallow submergent type. Mechanized techniques such as skimmers do not cause oil to become incorporated into the water column. Currently available dispersants produce temporary stress reactions in corals in laboratory tests. Particulate sinking agents should be avoided in the cleanup of oil spills near coral reefs. To assess the damage and recovery of coral reefs to oil pollution, studies at the organismal level should be conducted before community level impacts are examined. Difficulty arises in assessing the recovery of reefs from oil spills because little data exists for comparative purposes and recovery is a long term process. Reef rehabilitation may by transplanting coral planulae. More field studies are needed on the recovery after oil spills of complex coral reef systems.
W86-00243

FISHERIES RESOURCE IMPACTS FROM SPILLS OF OIL OR HAZARDOUS SUBSTANCES,
Environmental Research Lab., Gulf Breeze, FL.
W. P. Davis, D. E. Hoss, G. I. Scott, and P. F. Sheridan.
In: Restoration of Habitats Impacted by Oil Spills, Butterworth, Boston. 1984. Edited by John Cairns, Jr. and Arthur L. Buikema, Jr., p 157-172, 1 Tab, 37 Ref.

Descriptors: *Oil spills, *Fisheries, *Environmental impact statement, *Oil pollution, *Water pollution effects, *Ecological effects, *Marine fisheries, *Economic aspects, Environmental effects, Fish, Toxicity, Oil, Fish stocking, Aromatic compounds, Cleanup operations, Shellfish.

Studies have shown that, in general, refined petroleum products are more toxic than crude oils to marine organisms. The toxicity of aromatic hydrocarbons increases with increasing molecular size. To protect identified fisheries from oil spills, shellfish may be harvested in 'fenced off' areas or be transferred to safer areas prior to contamination. Attempts to obtain comparative assessments of impacts on fisheries have been made during a number of oil spills by using such techniques as echo sounding, species counting, aerial observations, and grid sampling methods. In Japan, the help of fishermen was enlisted when oil threatened a major fishery. All catches were carefully monitored for contamination and economic damages were calculated. Population restoration after oil spills can be accomplished by restocking. Areas that require further study are the relation of species or population stress to actual impact, use of dispersants, determination of recovery times, measurement techniques for sublethal effects and continued monitoring of spill areas to evaluate effectiveness of restoration efforts.
W86-00244

EFFECTS, PATHWAYS, PROCESSES, AND TRANSFORMATION OF PUGET SOUND CONTAMINANTS OF CONCERN,
E.V.S. Consultants Ltd., North Vancouver (British Columbia).
For primary bibliographic entry see Field 5B.
W86-00293

ETHYLENE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
August 1984. 58 p, 15 Fig, 6 Tab, 137 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Ethylene, *Hydrocarbons, *Chemical spills, *Spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Lakes, Fishkill, Environmental effects, Pollutant identification, Chemical properties, Physical properties.

Information useful for designing countermeasures for ethylene spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, suggested countermeasures, and analytical methods. When spilled into water, liquid ethylene simultaneously vaporizes and spreads on the surface. It is relatively insoluble in water. Nomograms are given for calculating rate of spreading on still water. The 4-day medium lethal toxicity rating for aquatic life is 1000 to 100 mg per liter. A fishkill is reported in fresh water at a concentration of 22-252 mg per liter and exposure of 1 hr. Ethylene disperses rapidly without bioaccumulation or food chain contamination potential. If necessary, ethylene-contaminated water may be aerated. Since chlorination in the presence of ethylene can form dichloroethane, drinking water contaminated with ethylene should be aerated before chlorination.
W86-00303

5D. Waste Treatment Processes

EFFECTS ON GROUNDWATER QUALITY OF THE INTRODUCTION OF SECONDARY SEWAGE TREATMENT TO AN EFFLUENT RECHARGE SITE ON THE CHALK OF SOUTHERN ENGLAND,
Water Research Centre, Marlow (England).
K. M. Baxter.
Journal of Hydrology, Vol. 77, p 333-359, 1985. 8 Fig, 7 Tab, 16 Ref. Commission of the European Communities contract ENV-399-UK(N).

Descriptors: *Groundwater contamination, *Secondary wastewater treatment, *Artificial recharge, *England, *Chalk aquifer, Wastewater disposal, Wastewater treatment, Effluent, Recharge, Fate of pollutants.

Detailed investigations were carried out at a site on the Chalk of southern England between 197 and 1982 to determine the effects of sewage effluent recharge on groundwater quality. Before 198 screened crude domestic sewage was recharged t the Chalk via a series of lagoons. During 1981 secondary-treatment works was commissioned o the site and the effluent recharged through a ne subsurface drain network. Monitoring of the ino ganic, organic and microbiological quality of effl ent and groundwater continued through t change-over, enabling the effects of the ne regime to be assessed. The recharge of sewag effluent to groundwater was shown to be an effe

way of ameliorating the effluent quality. Fol-
ing the introduction of secondary treatment at
site there seems to have been little change in
degree of contaminant removal. (Author's ab-
ct)
)-00043

STEWATER REUSE AND EXPOSURE TO
GIONELLA ORGANISMS,
assah Medical School, Jerusalem (Israel). En-
nmental Health Lab.
primary bibliographic entry see Field 5C.
)-00054

XIC ORGANICS REMOVAL KINETICS IN
ERLAND FLOW LAND TREATMENT,
l Regions Research and Engineering Lab.,
over, NH.
. Jenkins, D. C. Leggett, L. V. Parker, and J.
liphant.
er Research, Vol. 19, No. 6, p 707-718, 1985. 4
11 Tab, 32 Ref.

criptors: *Toxic substances, *Organic com-
nds, *Wastewater treatment, *Land treatment,
erland flow, Water treatment, Volatilization,
orption, Sorption.

efficiency in removing 13 trace organics from
ewater was studied on an outdoor, prototype
land flow land treatment system. More than
of each substance was removed at an applica-
rate of 0.4 cm/h (0.12 cu m/h/m of width).
% removals declined as application rates were
eased. Removal from solution was described
rst-order kinetics. A model based on the two-
theory was developed using three properties
ach substance (the Henry's constant, the octa-
water partition coefficient and the molecular
ght) and two system parameters (average water
h and residence time). The dependence of the
oval process on temperature was consistent
the known dependence of Henry's constant
diffusivity on temperature. The model was
d on a second overland flow system. (Author's
act)
)-00057

MPUTER SIMULATION OF AN INDUSTRI-
WASTEWATER TREATMENT PROCESS,
tana Coll. of Mineral Science and Technolo-
Butte. Dept. of Chemistry and Geochemistry.
. Jenke, and F. E. Diebold.
er Research, Vol. 19, No. 6, p 719-724, 1985. 1
6 Tab, 7 Ref. U.S. Bureau of Mines grant
5042.

criptors: *Computer models, *Wastewater
ment, *Industrial wastewater, Mixing, Lime,
l mine drainage, Mine drainage, Acid streams,
mical reactions.

computer program REDEQL.EPAK has
modified to allow for the prediction and
lation of the chemical effect of mixing two or
e aqueous solutions and one or more solid
es. In this form the program is capable of
elling the lime neutralization treatment process
acid mine waters. In its present form, the
ram calculates the speciation of all influent
ions, evaluates the equilibrium composition of
mixed solution and provides the stoichiometry
ie liquid and solid phases produced as a result
ie mixing. The program is used to predict the
mum treatment effluent composition, to deter-
e the amount of neutralizing agent (lime) re-
ed to produce this optimum composition and
rovide information which defines the mecha-
controlling the treatment process. (Author's
act)
)-00058

XICITY TO DAPHNIA OF THE END PROD-
TS OF WET OXIDATION OF PHENOL AND
STITUTED PHENOLS,
higan Technological Univ., Houghton. Dept.
iological Sciences.
Keen, and C. R. Baillod.
er Research, Vol. 19, No. 6, p 767-772, 1985. 6
Fig, 5 Tab, 12 Ref. EPA grant R805565-010.

Descriptors: *Toxicity, *Daphnia, *Water pollution effects, *Wet oxidation, *Phenols, Wastewater treatment, Oxidation, Bioassays, Water treatment.

The process of wet oxidation breaks down organic substances in aqueous solution at elevated temperatures and pressures. Experimental wet oxidations were carried out on pure solutions of phenol, 2-chlorophenol and 4-nitrophenol. After 1-h wet oxidation, final concentrations of these compounds averaged 3% of their concentrations in the starting solutions. The toxicities of the starting compounds and the residual toxicity of the end-product solutions were measured with 48-h acute toxicity tests using Daphnia magna. The solutions of end products were all less toxic than the starting solutions by factors ranging from 10 to 120. However, the end-product solutions were somewhat more toxic than would be predicted from the known concentration of initial compound remaining in the solution of end products. (Author's abstract)
W86-00064

POINT SOURCES-NONPOINT SOURCES TRADING IN THE LAKE DILLON WATERSHED.
Northwest Colorado Council of Governments, Frisco.
For primary bibliographic entry see Field 5B.
W86-00167

DEPOSIT CONTROL TECHNOLOGY FOR KRAFT RECOVERY UNITS,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
H. N. Tran.
Environmental Protection Service, Ottawa, Ontario. Report EPS 3/PF/1, December 1984. 26 p, 21 Fig, 2 Tab, 7 Ref.

Descriptors: *Wastewater treatment, *Industrial wastes, *Pulp and paper industry, *Kraft mills, *Pulp wastes, Bleaching wastes, Waste recovery, Automation, Monitoring, Economic aspects, Models.

This report describes the development of an on-line instrument for measuring the rate of accumulation of fireside deposits in the superheater and boiler sections of kraft recovery units. The recovery unit eliminates the lignin and other wood components dissolved in the black liquor and recovers and regenerates the inorganic pulping chemicals while producing steam for power generation and process heating. Large accumulations of fireside deposits plug flue gas passages and ultimately limit kraft recovery unit capacity and pulp mill production. Sootprobe offers the opportunity for increased pulp production through improved deposit control. It is estimated that, in a nominal 750-ton/day kraft mill, the use of this technology would result in an incremental pulp production of $26 million/yr, and an energy savings of $200 thousand. Results of three trials of the research models of sootprobe at a kraft mill in Ontario show that the accumulation of deposits in the superheater and boiler bank regions in kraft recovery units can be continuously measured using sootprobe. The signal from sootprobe is reliable. Sootprobe can be used to monitor flue gas temperatures. Deposit accumulation rates in the superheater and boiler bank regions vary significantly at the same black liquor firing load. Sootprobe provides a feedback signal to the operator so that he can adjust firing conditions to minimize deposit accumulation rate.
W86-00170

ENVIRONMENTAL ENGINEERING,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5F.
W86-00188

FLOW BALANCING METHOD FOR STORMWATER AND COMBINED SEWER OVERFLOW.
Swedish Council for Building Research, Stockholm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-124453. 1982. 27 p, 8 Fig, 5 Photos.

Descriptors: *Wastewater treatment, *Flow control, *Equalizing, *Lake restoration, *Storm wastewater, *Combined sewer overflows, Peak flow, Varied flow, Water pollution control, Runoff, Storm runoff, Overflow.

A low-cost flow balancing plant for storm water discharges and combined sewer overflows was demonstrated at Lake Trehorningen near Stockholm, Sweden. Floating tanks consisting of pontoons with reinforced vertically hanging plastic curtains are anchored to the bottom of the receiving water body. They operate as a horizontally working balancing system using the plug flow principle. The surrounding water functions as a balancing medium. When storm water discharge exceeds the pumping capacity of the treatment plant, the polluted storm water pushes the lake water from one floating tank compartment to the next in the flow direction. When storm water discharge is less than the pumping capacity of the treatment plant, the flow is reversed, allowing lake water to successively enter the floating tank compartments. During dry weather lake water may be pumped through the treatment plant to improve water quality. Experiences at three similar installations are described.
W86-00191

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE TEXTILE MILLS POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
For primary bibliographic entry see Field 5G.
W86-00207

OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS, AUGUST, 1981-OCTOBER, 1982: CITATIONS FROM THE NTIS DATA BASE.
National Technical Information Service, Springfield, VA.
Available from the National Technical Information Sevice, Springfield, VA 22161 as PB83-801365. December 1982. 183 p.

Descriptors: *Mine wastes, *Bibliographies, *Oil shale, *Industrial wastes, *Wastewater treatment, *Water pollution control. *Water quality control, Gasification, Pollutant identification, Leachates, Shales, Environmental effects, Ecological effects, Groundwater pollution, Streams, Water requirements.

This bibliography contains 183 abstracts of government-funded research on oil shale. Among the water-related subjects are water pollution control, waste and wastewater characterization and treatment, leachates, effect on groundwater and stream water quality, environmental and ecological impacts of wastes, water requirements, social and economic impacts, and hydrological aspects. All these entries are new since the last edition.
W86-00215

NEW CONCEPTS AND PRACTICES IN ACTIVATED SLUDGE PROCESS CONTROL,
Arthur Technology, Inc., Fond du Lac, WI.
R. M. Arthur.
Activated Sludge Process Control Series, Ann Arbor Science, Ann Arbor, MI. 1982. 125 p.

Descriptors: *Wastewater treatment, *Activated sludge, *Biological wastewater treatment, *Monitoring, *Process control, *Activated sludge process, *Aeration, *Mixed liquor solids, Sludge, Suspended solids, Denitrification, Control systems, Systems engineering.

Process control in the wastewater treatment plant is the responsibility of the plant operator. The engineer aids the plant operator in his job by

designing a plant which has the flexibility and controllability needed to produce high quality effluents. On-line instrumentation provides the basis for process control. In conventional plug flow activated sludge plant, aeration, return of settled sludge, and mixed liquor suspended solids are controllable elements. Conventional activated sludge systems can be modified by contact stabilization, extended aeration, and use of pure oxygen. Control methods may be manual or of the microprocessor, computer control or adaptive control types. Control modes available are on-off controls, ratio control, proportional control, proportional plus integral control, and proportional plus derivative control. The four measurements of the biological system important in process control include progress of metabolism, the state of denitrification, the concentration of viable microorganisms and the aerobic-anaerobic stage of respiration. The sensors that are available to monitor these factors are discussed along with various control schemes for the activated sludge process.
W86-00221

CHEMICALS AND WETLANDS,
For primary bibliographic entry see Field 5C.
W86-00233

MODELING OF AN ANFLOW MUNICIPAL WASTE-TREATMENT UNIT,
Massachusetts Inst. of Tech., Oak Ridge, TN. School of Chemical Engineering Practice.
D. J. Halbert, and R. J. Wojtowicz.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-16617. ORNL/MIT-342, June 1982. 65 p, 10 Fig, 7 Tab, 21 Ref, Contract/Grant No. W-7405-eng-26.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Model studies, Biological wastewater treatment, ANFLOW reactor, Computer programs, Methane, Kinetics, Upflow reactor.

A computer program, ANFLOW.F4, was written to model the anaerobic upflow, or ANFLOW bioreactor, developed in the Chemical Technology Division at Oak Ridge National Laboratory. The program predicts sludge accumulation rates, effluent liquid composition, and effluent gas flow rate and composition as a function of time following a change in inlet flow rate or composition. The model can be used to qualitatively study ANFLOW behavior. The ANFLOW reactor was modeled as a settling tank and a series of continuous stirred-tank reactors (CSTR). Residence-time-distribution experiments on the uninoculated column indicate that it is best modeled by two to five CSTRs in series. The number of CSTRs was left as an input parameter in the computer program. A reaction scheme based on conversion of soluble chemical oxygen demand first to volatile acids by acetogenic bacteria and then to methane and carbon dioxide by methanogenic bacteria was selected. Monod and inhibition kinetics were used for acetogenesis and methanogenesis, respectively. Material balances were written for 14 components in each CSTR. Kinetic and equilibrium constants were extracted from the literature, and a numerical integration technique was used to solve the time-dependent steady-state solutions of the material balances. The program was successfully tested for one CSTR. (Author)
W86-00246

EVALUATION OF THE 'LECTRO CLEAR Z' ELECTROCOAGULATION PROCESS FOR MEAT PACKING WASTEWATER TREATMENT.
Western Industrial Labs. Ltd., Edmonton (Alberta).
Report No. EPS 4-WP-82-1, January 1982. Environmental Protection Service, Ottawa, Ontario. 92 p, 4 Fig, 4 Tab, 4 Append.

Descriptors: *Wastewater treatment, *Meat processing industry, *Flotation, Lectro Clear Z unit, Industrial wastewater, Biological wastewater treatment, Coagulation.

The Lectro Clear Z unit is used to pretreat wastes from a meat packing plant in Lethbridge, Alberta. The unit's basic principle is formation of a floc by adjustment of the wastewater pH to 4.0-4.5 with sulfuric acid or sodium hydroxide, addition of chemical, and electrolysis to form hydrogen and oxygen. The gas bubbles float the floc to the surface where it is skimmed. Average BOD in the influent wastewater is 647 mg per liter; average effluent, 284 mg per liter, with a removal of 50%-70%. Suspended solids removals are 68%, from an average of 522 to 173 mg per liter.
W86-00252

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING, 1978-1979,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
For primary bibliographic entry see Field 10C.
W86-00289

5E. Ultimate Disposal Of Wastes

SEAWATER CIRCULATION IN SEWAGE OUTFALL TUNNELS,
New South Wales Univ., Kensington (Australia). Water Research Lab.
D. L. Wilkinson.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 846-857, May, 1985. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Seawater, *Saline water intrusion, *Wastewater outfall, *Outfall tunnels, Tunnels, Design criteria, Wastewater disposal, Model studies.

As a means of maintaining water quality along the foreshores, sewage wastes at certain sites have been conveyed offshore through tunnels excavated beneath the sea floor and released into the ocean through a series of vertical shafts or risers. The risers are typically 2 to 5 km offshore. The failure of the outfalls at Aberdeen (Scotland) and Weymouth (England) to function as originally planned has been attributed to the intrusion of seawater into the outfall tunnel. Model studies showed that the dense seawater can form a wedge structure in the tunnel which completely blocks the sewage discharge from the more seaward risers; seawater circulates through the more seaward risers to be discharged into the ocean through the riser located immediately above the wedge. A different mode of blocking called circulation blocking occurs when seawater is drawn down the more shoreward risers and a mixture of sewage and seawater discharges from the seaward risers. The magnitude of the circulation was determined in terms of the sewage flow and geometric parameters of the outfall. An expression was derived for the sewage flow required to arrest the circulation. Circulation blocked outfalls will clear when the sewage inflow exceeds a critical flow rate; however, like wedge blocked outfalls, the flow required to achieve is many times greater than the flow needed to prevent intrusion into the diffuser ports. Tunnelled ocean outfalls should be constructed with the design capacity discharge required to purge an outfall subject to circulation blocking. (Collier-IVI)
W86-00017

DIGITAL SIMULATION OF THE REGIONAL EFFECTS OF SUBSURFACE INJECTION OF LIQUID WASTE NEAR PENSACOLA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-00122

POTENTIAL FOR CONTAMINATION OF SHALLOW AQUIFERS IN ILLINOIS,
Illinois State Geological Survey Div., Champaign.
R. C. Berg, J. P. Kempton, and K. Cartwright.
Circular 532, 1984. 30 p, 12 Fig, 2 Tab, 2 Plates, 40 Ref.

Descriptors: *Aquifers, *Waste disposal, *Geological mapping, *Groundwater pollution, *Illinois, Mapping, Geohydrology, Geological surveys, Municipal wastes, Solid waste disposal, Underground waste disposal.

The potential for contaminating groundwater resources is a critical concern in Illinois. Contamination may result from land burial of municipal wastes and surface or near-surface disposal of wastes. Aquifers are susceptible to contamination because their hydrogeologic properties allow waste effluents to travel rapidly. Whether a shallow aquifer actually becomes contaminated also depends on the properties of the earth/geologic materials that surround it. The purpose of this project was to describe and map geologic materials to a depth of 50 ft throughout the state of Illinois. The combination of hydrogeologic properties and stratigraphic position of geologic materials provides the basis for mapping the potential for contaminating aquifers. Two maps constructed for this study show the distribution of sequences of geologic materials and their comparative ratings. Each sequence was rated for the susceptibility of its water-yielding materials (aquifers) to contamination from waste-disposal practices. The maps are presented at a scale of 1:500,000 for the entire state. They may be used for suggesting areas where disposal of wastes will have minimum potential for contaminating groundwater resources and for screening areas with low contamination potential as part of the process of locating new disposal sites.
W86-00178

MODIFICATION OF BELL CANYON TEST (BCT) 1-FF GROUT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8G.
W86-00248

5F. Water Treatment and Quality Alteration

ADVANTAGES OF DISSOLVED-AIR FLOTATION FOR WATER TREATMENT,
Water Research Centre, Stevenage (England).
T. Zabel.
American Water Works Association, Vol. 77, No. 5, p 42-46, May, 1985. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Dissolved-air flotation, *Water treatment, *Physicochemical treatment, Design criteria, Algae, Sedimentation, Flocculation, Coagulation, Turbidity, Softness.

Many raw water sources contain low-density particles such as algae, which, because of their tendency to float, cause problems in the sedimentation stage. In particular, nutrient-rich stored waters that may contain heavy algae blooms are difficult to treat by sedimentation. In addition, treatment of low turbidity, soft, highly colored waters produces very light flocs that settle very slowly. Dissolved-air flotation as a primary clarification stage for the production of potable water is particularly effective for the treatment of these waters. Dissolved-air flotation plants consist of a facility to mix the coagulation chemicals with the raw water and a mechanical flocculation stage, followed by a flotation tank. Part of the treated water is recycled, pressurized, and saturated with air and then introduced to the flocculated water stream via a bank of air injection nozzles. The pressure is reduced to atmospheric pressure across the nozzles thus releasing the air in the form of fine bubbles. The air bubbles attach themselves to the flocs and the bubble-floc agglomerates rise to the surface of the flotation tank and are removed as floated sludge either by flooding or mechanical scraping. Flotation has several process advantages over sedimentation: It can produce better water quality; it can be operated at high surface loadings, resulting in relatively small and shallow plants; and it can be started up quickly, with a steady water quality being achieved within 45 min. Also, the solids concentration of the sludge produced is significantly higher (about 3 percent) than that of sludge produced by sedimentation. Detailed information

ven on the design of flocculation and flotation
s, the air saturation system, the production of
robubbles, and the different sludge removal
ems that can be used. Performance data are
n for flotation plants used for clarification of
ral raw waters, with special emphasis on the
ment of algae-laden waters and low-turbidity,
ly colored waters. (Collier-IVI)
5-00005

MOVING BARIUM AND RADIUM
ROUGH CALCIUM CATION EXCHANGE,
2M Hill, Milwaukee, WI.
G. Myers, V. L. Snoeyink, and D. W. Snyder.
nal of the American Water Works Associa-
Vol. 77, No. 5, p 60-66, May, 1985. 11 Fig, 5
14 Ref. EPA contract CR-808912.

criptors: *Barium, *Radium, *Cation ex-
ge, *Water treatment, Drinking water,
undwater treatment, Ion exchange.

removal of barium and radium, which are
d in many groundwater sources, was achieved
boratory studies with an ion exchange process.
rong acid resin in the Ca form achieved excel-
removal of Ba(2+) and Ra(2+) from water
aining 15-30 mg Ba(2+)/L and 43 pCi Ra-
L. The resin was regenerated easily with
12 brine, and after repeated exhaustion-regen-
on cycles using reclaimed brine, the only
r quality change observed during the produc-
cycle was the reduction of the Ba(2+) and
26 concentrations. Total hardness, alkalinity,
and other parameters were essentially un-
ged. Operation of this column in parallel with
rong acid, Na-form column will enable the
luction of water that meets the standards for
nd Ra and has the hardness desired for distri-
on. The capacity of the virgin Ca-form column
Ba(2+) was approximately 75 mg Ba(2+)/g
resin (H+ form) or 32 g Ba(2+)/l resin (Ca
). The capacity of the column after several
ustion-regeneration cycles depends on the
ge of regenerant. The CaCl2 regenerant con-
ration of 0.85M was significantly more effec-
at a given dosage than higher (1.69M) or
r (0.42M) concentrations. The spent CaCl2
e can be reclaimed for reuse. The brine recla-
on process should significantly reduce the
e disposal problem, but ways of disposing of
precipitates must be found, and the cost in-
ed in using the process must be established.
er-IVI)
5-00008

WA SURVEY OF INORGANIC CONTAMI-
NTS IN WATER SUPPLIES.
nal of the American Water Works Associa-
Vol. 77, No. 5, p 67-72, May, 1985. 12 Fig, 5

criptors: *Drinking water, *Quality control,
ited States, *Surveys, *Inorganic compounds,
ates, Sulfates, Regulations, Arsenic, Fluoride,
um, Lead, Selenium, Cadmium, Mercury,
mium, Silver.

lts of a survey of the United States and its
tories on the frequency and extent of inorganic
aminants in drinking water supplies are report-
s prepared by AWWA's Inorganic Contami-
s Committee, Water Quality Division. Data
presented on the inorganic contaminants listed
he US EPA primary and secondary drinking
r regulations. Thirty-nine states responded to
survey with 37 providing data. Problems with
ting the primary inorganic maximum contami-
levels (MCLs) are most common in small
munities served by wells (98.4%) rather than
hose served by surface water (1.6%). High
te concentrations were the primary reason for
tivating wells or systems that were reported to
e been shut down. High fluoride was the next
t frequently reported reason. Response data
e scarce on systems that had been shut down.
rms of frequency only, the main difficulties in
ting the primary MCLs were a result of fluo-
nitrate and to a much lesser extent, selenium,
nic, barium, and lead contamination. Geo-
hic distribution patterns are clear for the oc-
currences of excessive nitrate, selenium, barium and arsenic. Ninety percent of the excess fluoride and nitrate-N occurrences were less than 5.0 mg/L and 20.0 mg/L, respectively. The remaining 10% still represent a significant number of water supplies. Twenty-six states responded with actual or estimated data on the secondary inorganic contaminants. If these data are linearly extrapolated for all 50 states, there are about 28,000 occurrences of contaminants in excess of the secondary MCNs. The most common secondary MCL contaminants are iron, manganese, and dissolved solids. Sulfates, chloride, and color are also quite significant. (Baker-IVI)
W86-00009

IN-HOME TREATMENT METHODS FOR REMOVING VOLATILE ORGANIC CHEMICALS,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. K. Sorrell, E. M. Daly, M. J. Weisner, and H. J. Brass.
Journal of the American Water Works Association, Vol. 77, No. 5, p 72-78, May, 1985. 6 Fig, 13 Tab, 13 Ref.

Descriptors: *Volatile compounds, *Organic compounds, *Drinking water, *Water treatment, Boiling, Electric mixing, Aeration.

The effectiveness of six in-home treatment methods for removing volatile organic chemicals (VOCs) from drinking water was investigated. At least two methods appeared excellent for temporary use in emergency situations. Boiling and electric mixing afforded about 100% removal of the test compounds (chloroform, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene, bromoform, tetrachloroethylene, t-butyl methyl ether, benzene, ethylbenzene, m-xylene, and m-dichlorobenzene) using ordinary kitchen appliances, in phase 1. Phase 1 of the testing involved six methods - boiling, electric mixing, open standing, aeration, pouring and faucet aeration. The first four methods were reexamined in phase 2, during which VOC loss over time was monitored. Loss of VOCs by boiling was found to be variable. This variability was likely due to the lower heating efficiency of the household stove which made it difficult to determine the start of boiling. The estimated cost per month of treating water by boiling for a family of four would be about $4.70. Electric mixing provided excellent removal of VOCs in phases 1 and 2. The estimated cost to a household was about $0.30 per month using this method. A third method, open standing, provided reasonable removal without any significant compound bias. However, the length of treatment required, 48-72 hr, is excessive. Aeration was less effective and very compound dependent. While the risk of inhaling volatile organic chemicals evolved from water is basically unknown, it may be of a similar magnitude to that of ingesting water containing such chemicals, if very large volumes are being treated. This risk is also involved in such activities as cooking, showering, bathing, and using humidifiers and vaporizers. (Baker-IVI)
W86-00010

REMOVAL BY COAGULATION OF TRACE ORGANICS FROM MISSISSIPPI RIVER WATER,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
M. J. Semmens, and K. Ayers.
Journal of the American Water Works Association, Vol. 77, No. 5, p 79-84, May, 1985. 15 Fig, 4 Tab, 26 Ref. EPA grant CR806377.

Descriptors: *Mississippi River, *Organic compounds, *Water treatment, *Coagulation, Salicylic acid, Acidity, Trace compounds, Octanoic acid, Phenols, Benzoic acid, Organic matter.

Studies were conducted on the removal of four truly soluble, low-molecular weight model compounds (octanoic acid, phenol, benzoic acid, and salicylic acid) by coagulation with alum and iron salts. The model compounds were generally poorly removed by coagulation. The extent of removal was weakly dependent on coagulant dosage except for salicylic acid, which showed improved removal at higher dosages in the presence of natural organics. Removal of the model organic compounds was generally better in the absence of natural organic matter. Percentage removals of the model organic compounds were similar to the removals of the <1K molecular weight fraction of the natural organic matter. The pH influenced the removal of compounds containing a phenolic-OH functional group but did not influence those containing only carboxylic acid functional groups. Coagulation removed intermediate and high molecular weight organic compounds (1-10K and 10-100K) most effectively. Removal of the model organic compounds by coagulants appeared to result from complex formation and precipitation, with the soluble metal-organic complexes formed at the low concentration (about 8 x 10 to the minus 7th power) tested limiting the extent of removal. Simple adsorption does not appear to be a significant mechanism of removal under the conditions tested. (Baker-IVI)
W86-00011

EFFECTS ON GROUNDWATER QUALITY OF THE INTRODUCTION OF SECONDARY SEWAGE TREATMENT TO AN EFFLUENT RECHARGE SITE ON THE CHALK OF SOUTHERN ENGLAND,
Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 5D.
W86-00043

FATE OF ALDICARB, ALDICARB SULFOXIDE, AND ALDICARB SULFONE IN FLORIDAN GROUNDWATER,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W86-00045

RAINWATER CATCHMENT WATER QUALITY IN MICRONESIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3B.
W86-00061

COMPARATIVE EFFECTIVENESS OF ANTIFOULING TREATMENT REGIMES USING CHLORINE OR A SLOW-RELEASING BROMINE BIOCIDE,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Biology.
R. J. Soracco, E. W. Wilde, L. A. Mayack, and D. H. Pope.
Water Research, Vol. 19, No. 6, p 763-766, 1985. 2 Fig, 9 Ref.

Descriptors: *Fouling, *Antifouling, *Chlorine, *Biocides, *Bromine biocides, Heat exchangers, Water treatment, Cooling water, Pesticides, Industrial water.

Five chlorine (Cl2) and three slow-releasing bromine biocide (1-bromo-3-chloro-5,5-dimethylhydantoin (BCDMH)) treatment regimes were compared under laboratory conditions to determine their effectiveness in controlling the fouling of 304L stainless steel heat exchanger tubing. The most effective Cl2 treatments were low level (0.1 ppm or less) continuous applications. Three intermittent Cl2 treatments (1 h/day at 1.0 ppm, 1 h/day at 0.5 ppm, and 3 x 20 min/day at 0.5 ppm) were about equally effective. However, all three intermittent regimes were significantly less effective than the low level continuous treatments. The effectiveness of BCDMH treatment was similar to Cl2 when used intermittently at similar residual concentrations at Cl2 for 1 h/day and continuously at low levels. These experiments indicated that low level continuous treatment was more effective than intermittent treatment for controlling biofouling. (Author's abstract)
W86-00063

INACTIVATION OF NAEGLERIA GRUBERI CYSTS BY CHLORINE DIOXIDE,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
Y. S. R. Chen, O. J. Sproul, and A. J. Rubin.
Water Research, Vol. 19, No. 6, p 783-789, 1985. 6 Fig, 4 Tab, 27 Ref. U.S. EPA Office of Exploratory Research grant R808150-02-0.

Descriptors: *Naegleria, *Protozoans, *Chlorine dioxide, *Water treatment, *Cysts, Hydrogen ion concentration, Water temperature, Disinfection, Ozonation, Poliovirus, Viruses.

The kinetics of chlorine dioxide inactivation of Naegleria gruberi cysts (a nonpathogenic soil and water protozoan closely related to the human parasite N. fowleri) were investigated as were the influence of pH from 5 to 9, temperature from 5 to 30 C, cyst age from 3 to 12 days, and cyst clumping. Survivals were obtained for each study as a function of time at several chlorine dioxide concentrations. Inactivation was characterized by an initial concave downward shoulder followed by an essentially linear portion but the process obeyed Watson's Law. At 25 C and pH 7 the mean concentration time product for 99% inactivation was 5.5 mg x min/l. These products varied inversely with temperature and pH. The mean concentration time product for 99% inactivation roughly doubles for each 10 C rise in the water temperature. The actual ratios were 1.6 between 5 and 15 C and 1.7 between 15 and 25 C. Ozone has the lowest time-concentration products followed in order by chlorine dioxide and chlorine. Ozone is distinctly the better disinfectant under lower temperature and at pH's of 8 or less. At a pH of 9 and at 25 C chlorine dioxide approaches ozone in effectiveness. Chlorine, at pH's above 7, rapidly loses its effectiveness as the hypochlorous acid ionizes to the hypochlorite ion. The N. gruberi cyst is distinctly more difficult to inactivate than poliovirus 1 but on the same order as bacterial spores. (Collier-IVI)
W86-00066

OPTIMAL URBAN WATER DISTRIBUTION DESIGN,
MacLaren Engineers, Winnipeg (Manitoba).
D. R. Morgan, and I. C. Goulter.
Water Resources Research, Vol. 21, No. 5, p 642-652, May, 1985. 7 Fig, 9 Tab, 19 Ref.

Descriptors: *Linear programming, *Water conveyance, *Hardy-Cross network solver technique, Cost analysis, Economic factors, Model studies, Optimization.

An iterative procedure capable of analyzing both layout and design of new systems and expansion of existing systems has been developed. One of the major advantages of the technique is that it ensures hydraulic consistency in each of the networks considered during the iterative procedure. In the design of new systems a wide range of loading patterns and pipe failure combinations can be considered. The manner in which the large number of constraints associated with all possible load combinations is reduced to a manageable size does not permit a claim for global optimality. The procedure must therefore be classified as heuristic. The results obtained by the procedure show that it is capable of efficiently producing economical solutions. The method has been demonstrated as being applicable to the layout and design of a network of 2 sources, 20 nodes, and 37 links, and the expansion of an existing network. Comparison of the results produced by this procedure for a network expansion problem with the results of previous studies for the same problem shows that this procedure produces an inexpensive solution in an efficient manner. The procedure is relatively simple, being based on two widely available and accepted techniques, the Hardy-Cross Network solver and linear programming operations research technique. The ability of the model to use the very efficient simplex algorithm of the linear programming makes the procedure applicable to large systems. The method also utilizes realistic and easily accessible pipe cost functions using standard cost data, i.e., cost per unit length. (Baker-IVI)
W86-00071

CHEMISTRY FOR OPERATORS,
Muskegon County Board, MI. Dept. of Public Works.
R. L. Fountain.
Water Treatment Plant Operation Series, Volume 4, Ann Arbor Science, Ann Arbor, MI. 1982. Edited by V. W. Langworthy. 148 p.

Descriptors: *Chemical reactions, *Reviews, *Wastewater treatment, Chlorination, Alkalinity, Coagulation, Flocculation, Phosphorus removal, Water softening, Nitrogen.

This book was written to provide the operators of water and wastewater treatment plants with a basic course in chemical theory and the chemical reactions that occur at such facilities. The first eight chapters cover basic theory and principles essential to all chemical reactions. The remaining chapters deal with chlorination, alkalinity, coagulation and flocculation, water softening, and phosphorus and nitrogen removal. Each chapter concludes with a set of problems and their solutions. The chapter on chlorination explains oxidation-reduction reactions, reactions with impurities, breakpoint chlorination, and the determination of chloride residuals. The chapter on alkalinity discusses the determination of alkalinity. The causes of turbidity and color are discussed in the chapter on coagulation and flocculation, along with the control of coagulation, the jar test, and zeta potential. The lime-soda process and the ion exchange process are considered in the chapter on water softening. In the chapter on phosphorus and nitrogen removal, nitrogen removal by biological nitrification-dentrification, breakpoint chlorination, selective ion exchange, and air stripping of ammonia is considered.
W86-00134

HYDRAULICS FOR OPERATORS,
Michigan Dept. of Public Health, Lansing. Section of Water Supply.
For primary bibliographic entry see Field 8B.
W86-00135

ENVIRONMENTAL ENGINEERING,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
P. A. Vesilind, and J. J. Peirce.
Butterworth, Boston. 1982. 602 p.

Descriptors: *Water treatment, *Wastewater treatment, *Water analysis, *Water pollution sources, *Water pollution effects, *Public health, *Sludge treatment, *Sludge disposal, Nonpoint source pollution, *Water law, Radioactive wastes, *Water supply, *Water distribution, *Sewers, Biodegradation, Wastewater characteristics, Environmental effects, Landfills.

A textbook on environmental engineering is organized in five major areas: water resources, air quality, solid and hazardous wastes, noise, and environmental impact. Water-related topics include water pollution, measurement of water quality, water supply and transmission, water treatment methods, wastewater collection and treatment, sludge treatment and disposal, nonpoint source water pollution and its control, water pollution law, landfills, and environmental impact and assessment.
W86-00188

5G. Water Quality Control

SEAWATER CIRCULATION IN SEWAGE OUTFALL TUNNELS,
New South Wales Univ., Kensington (Australia). Water Research Lab.
For primary bibliographic entry see Field 5E.
W86-00017

HYPOLIMNETIC AERATION: PRACTICAL DESIGN AND APPLICATION,
British Columbia Ministry of Environment, Vancouver. Fisheries Research and Technical Services Section.
K. I. Ashley.
Water Research, Vol. 19, No. 6, p 735-740, 1985. 23 Ref, 1 Append. NRC grant 67-3454.

Descriptors: *Aeration, *Hypolimnetic aeration, *Lake restoration, *Fisheries managment, Destratification, Design criteria, Oxygenation.

Hypolimnetic aeration is becoming increasingly important as a fisheries management and water quality improvement technique, however its application has been restricted by a paucity of practical reference material. Hypolimnetic aeration includes partial and full lift designs and several air/oxygen injection systems. Positive displacement compressors flanged to three phase electric motors are the preferred air supply and power for most lake aeration projects. Internal combustion power is adequate for short term use and wind power is in the developmental stage. Rubber compressed air hose is recommended for lake aeration applications. Free air delivery is the air volume taken into the compressor at standard temperature and pressure however actual output volume is regulated by discharge pressure. Performance specifications of full lift hypolimnetic aerators are based on water:air ratios, oxygen increase, transfer efficiencies and oxygenation capacity. An empirical sizing method was developed using hypolimnetic volume, hypolimnetic oxygen consumption, water flow, air flow and inflow tube radius. Outflow tube radius should equal or exceed inflow tube radius to achieve high flow rates and allow efficient removal of residual bubbles. Floatation requirements were calculated from the total weight of the separator box, inflow and outflow tubes and the theoretical water head. (Author's abstract)
W86-00060

RELEASE OF ENDOTHALL FROM AQUATHOL GRANULAR AQUATIC HERBICIDE,
North Texas State Univ., Denton. Dept. of Biological Sciences.
K. H. Reinert, S. Stewart, M. L. Hinman, J. H. Rogers, Jr., and T. H. Leslie.
Water Research, Vol. 19, No. 6, p 805-808, 1985. 3 Fig, 3 Tab, 21 Ref.

Descriptors: *Herbicides, *Fate of pollutants, *Endothall, *Aquatic plants, *Pesticide kinetics, Kinetics, Fish, Sunfish, Water pollution effects.

The release rate kinetics of endothall from Aquathol Granular Aquatic Herbicide (Aquathol) were determined in two static shake flask tests and the release half-life was determined from the release rate. A zero-order release rate of 1.58 mg/l/h and a half-life of 5.06 h were calculated from the replicate studies. These experiments show that Aquathol releases endothall relatively rapidly in a static environment; however, this release would be expected to be faster in a dynamic aquatic system such as a reservoir where horizontal dispersion and dilution can occur. The release rate, when coupled with the fate processes affecting endothall persistence in aqueous systems and the relatively high endothall concentration required for acute toxicity to non-target organisms such as bluegill sunfish (428 mg/l), make Aquathol a candidate for control of nuisance aquatic vegetation where water usage are critical. (Collier-IVI)
W86-00068

APPLICATION OF THE STORM MODEL TO DESIGN PROBLEMS IN SINGAPORE AND IN KAOSIUNG, REPUBLIC OF CHINA,
Camp, Dresser and McKee, Inc., Boston, MA
For primary bibliographic entry see Field 6A.
W86-00086

MIXING ZONE MODEL FOR CONSERVATIVE PARAMETERS,
Oklahoma Water Resources Board, Oklahoma City.
M. R. Hutcheson.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 198. University of Florida, Gainesville. p 65-86, 11 Fig, 1 Tab, 12 Ref.

scriptors: *Model studies, *Waste load, ixing, Water quality, *Water quality manag- nt, *Mathematical studies, *Water quality stand- s, *Numerical analysis, Models, Nonpoint pol- on sources, Wastewater disposal, Water quality trol, Industrial wastes.

e development of a wasteload allocation process ch incorporates a numerical solution to the ersion equation is described. The methodology es on simplification of the dispersion equation ough the use of assumptions so that it may be ed numerically. Then a relationship between standard deviation of a Gaussian distribution the dispersion coefficient is derived. A rela- ship for the standard deviation, hence the dis- sion coefficient is developed based on hydrolo- and plume dimensions. The dispersion equation lved numerically for pollutant concentration at points throughout the mixing zone. The maxi- n concentration at the end of the mixing zone, related source strength, the background con- tration and the water quality standard are used letermine the wasteload allocation which will tect the water quality standard. This process is licable to multiple discharges as well as isolated s, using the superposition principle. The meth- logy was applied to an industrial point source rmland Industries) that discharges into Skeleton ek. It was demonstrated that the dispersion iel can predict concentration distributions well ugh to develop permit limits which will allow er quality standards in a receiving stream to be

6-00089

ME RECENT ADAPTATIONS AND APPLI- TIONS OF QUAL-II IN THE NORTHEAST,
primary bibliographic entry see Field 5B.
6-00090

VIEW OF MODEL USE IN EVALUATING NPOINT SOURCE LOADS FROM FOREST NAGEMENT ACTIVITIES,
ional Council of the Paper Industry for Air and eam Improvement Inc., New York.
primary bibliographic entry see Field 5B.
6-00091

CHANISTIC SIMULATION FOR TRANS- RT OF NONPOINT SOURCE POLLUT- TS,
ons, Li and Associates, Inc., Fort Collins, CO.
primary bibliographic entry see Field 5B.
6-00092

ANNING AND IMPLEMENTATION OF RE- ONAL STORMWATER MANAGEMENT FA- LITIES IN MONTGOMERY COUNTY, RYLAND,
enhorne and O'Mara, Inc., Riverdale, MD.
primary bibliographic entry see Field 4A.
6-00099

TRIENT INPUT FROM THE LOXAHAT- EE RIVER ENVIRONMENTAL CONTROL STRICT SEWAGE-TREATMENT PLANT TO E LOXAHATCHEE RIVER ESTUARY, UTHEASTERN FLORIDA,
ological Survey, Tallahassee, FL. Water Re- rces Div.
primary bibliographic entry see Field 5B.
6-00110

TIONAL WATER SUMMARY 1983--HY- OLOGIC EVENTS AND ISSUES.
ological Survey, Reston, VA. Water Resources
primary bibliographic entry see Field 6B.
6-00131

ONOMIC PERSPECTIVES ON ACID DEPO- TION CONTROL.
d Precipitation Series, Volume 8, Butterworth blishers, Boston, 1984. Volume edited by omas D. Crocker. Series edited by John I. Teas- ley. 180 p.

Descriptors: *Water quality control, *Acid rain, *Air pollution, Precipitation, *Economic aspects, Policy making, Fate of pollutants, Fisheries, Decision making, Cost analysis, Model studies, Legal aspects, Canada.

Papers on the economic aspects of acid aspects of acid deposition control are grouped into five general topics: (1) policy perspectives (the current level of scientific knowledge relative to possible control decisions), (2) economic benefits of control (dose-response estimation, economic damages to the Adirondack fisheries, and economic damages from a Canadian perspective), (3) international aspects (legal, economic, and political aspects of transfrontier pollution), (4) economically optimal control strategies, and (5) economic caveats.
W86-00136

ACID RAIN: DOES SCIENCE DICTATE POLICY OR POLICY DICTATE SCIENCE,
Georgia Univ., Athens. Inst. of Natural Resources.
For primary bibliographic entry see Field 6E.
W86-00137

EFFECT OF GLOBAL OPTIMIZATION ON LOCALLY OPTIMAL POLLUTION CONTROL: ACID RAIN,
West Virginia Univ., Morgantown. Dept. of Economics.
For primary bibliographic entry see Field 6C.
W86-00138

ECONOMICALLY RELEVANT RESPONSE ESTIMATION AND THE VALUE OF INFORMATION: ACID DEPOSITION,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W86-00139

SCIENTIFIC TRUTHS AND POLICY TRUTHS IN ACID DEPOSITION RESEARCH,
Wyoming Univ., Laramie. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W86-00140

NORMATIVE ECONOMICS AND THE ACID RAIN PROBLEM,
Oklahoma Univ., Norman. Div. of Economics.
For primary bibliographic entry see Field 6B.
W86-00141

ECONOMIC IMPACT OF ACID PRECIPITATION: A CANADIAN PERSPECTIVE,
Oklahoma Univ., Norman. Div. of Economics.
For primary bibliographic entry see Field 6C.
W86-00142

LEGAL, ETHICAL, ECONOMIC AND POLITICAL ASPECTS OF TRANSFRONTIER POLLUTION,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W86-00143

ACIDIFICATION IMPACT ON FISHERIES: SUBSTITUTION AND THE VALUATION OF RECREATION RESOURCES,
Clarkson Univ., Potsdam, NY. Dept. of Economics.
F. C. Menz, and J. K. Mullen.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 135-155, 3 Fig, 6 Tab, 44 Ref.

Descriptors: *Water pollution effects, *Cost analysis, *Acid rain, *Fisheries, Precipitation, Air pollution, Economic aspects, Adirondack Mountains, New York, Lake fisheries, Stream fisheries, Recreation, Model studies.

Economic losses to anglers in the Adirondack recreational fishery resulting from acidification damage were estimated at $1.7-3.2 million, depending on assumptions pertaining to habitat loss and substitution by anglers among fisheries. These were considered lower-bound estimates for the following reasons: (1) estimates were based only on licensed New York resident anglers fishing in waters open to public fishing, (2) they were based on the assumption that information concerning the effect of acidification on alternative fishing sites is known and accurately perceived by the angling population, (3) estimates of currently perceived damages may understate future damages if acidification is irreversible, and (4) results of this study pertained only to the currently observable effects of acidification on a limited portion of the Adirondack recreational fishery.
W86-00144

TRANSFERABLE DISCHARGE PERMITS AND PROFIT-MAXIMIZING BEHAVIOR,
Wyoming Univ., Laramie. Dept. of Economics.
J. T. Tschirhart.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 157-171, 3 Fig, 14 Ref, 1 Append.

Descriptors: *Water quality control, *Acid rain, *Air pollution, Water pollution control, Permits, Economic aspects, Transferable discharge permits, Precipitation, Profit, Regulations.

A model of a profit-maximizing firm was presented where the firm confronts an emission standard and has the options to either install scrubbers or enter into transferable discharge permit (TDP) markets. The results of the model characterize how the firm chooses among the options to meet the standard at minimum cost. However, the driving force behind the minimum cost solution is that the firm is a profit maximizer. There are situations where this may not be an appropriate assumption. For instance, in regulated industries where constraints on profits are invoked by government commissions, the minimum cost solution is not attained. A bias toward overutilization of scrubbers is possible. Even in nonregulated industries, however, there are plausible reasons why firms do not maximize profit, including uncertainty, organization complexity and alternative goals. All of this is not to say that TDP markets should be abandoned. Instead, this chapter contains a number of pitfalls that regulators should be aware of when implementing TDP markets. How important these pitfalls are is an empirical question that cannot be answered until the market are allowed to operate for some time. Until then, control agencies should closely observe those firms that may be candidates for these pitfalls, particularly those in regulated industries. And if their behavior deviated from that outlined above, adjustments in the TDP system are in order. (Author)
W86-00145

TECHNIQUES TO REDUCE THE SEDIMENT RESUSPENSION CAUSED BY DREDGING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
G. L. Raymond.
Miscellaneous Paper HL-84-3, September 1984. Final Report. 33 p, 14 Fig, 15 Ref.

Descriptors: *Suspended solids, *Dredging, *Suspended sediments, *Ecological effects, Bottom sediments, Dredges, Turbidity, Reviews, Fluvial sediments, Marine sediments, Design criteria, Polychlorinated biphenyls, Water resources development, Channel improvement.

As part of a larger effort under the Improvement of Operation and Maintenance Techniques Program to develop a method to predict the extent of sediment resuspension and contaminant release when dredging in contaminated sediments, the U. S. Army Engineer Waterways Experiment Station's Water Resources Engineering Group is conducting field studies to evaluate new and existing

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dredging methods. The level of sediment resuspended by a given dredge type in a given sediment was examined using various operational parameters. Results of the first 2 yr of study which included field work and extensive literature reviews show that different dredge types produce different amounts of suspended sediment in different parts of the water column. Resuspensions caused by cutterhead and hopper dredges tend to remain in the lower water column, while bucket dredges increase resuspensions throughout the water columns. The amount of resuspension caused by a given dredge type also depends on the operating techniques used with the dredge. Sediment resuspension can be lessened by changing operating techniques, as in the case of the cutterhead, or by modifying the equipment, such as enclosing a clamshell bucket. Special purpose dredges can also be used to reduce sediment resuspension, but their lower production rates limit their application.
W86-00159

POTENTIAL FOR CONTAMINATION OF SHALLOW AQUIFERS IN ILLINOIS,
Illinois State Geological Survey Div., Champaign.
For primary bibliographic entry see Field 5E.
W86-00178

SORPTION BEHAVIOUR OF 14C IN GROUNDWATER/ROCK AND IN GROUNDWATER/CONCRETE ENVIRONMENTS,
Seakem Oceanography Ltd., Sidney (British Columbia).
For primary bibliographic entry see Field 5B.
W86-00184

OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS, 1978-JULY, 1981: CITATIONS FROM THE NTIS DATA BASE.
National Technical Information Service, Springfield, VA.
For primary bibliographic entry see Field 4C.
W86-00201

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE TEXTILE MILLS POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-116871. EPA 440/1-82/022, September 1982. Final Report. 509 p, 11 Fig, 152 Tab, 238 Ref, 1 Append.

Descriptors: *Water quality control, *Wastewater treatment, *Textile mill wastes, *Industrial wastes, *Standards, *Effluent limitations, *Water pollution sources, *Wastewater composition, Water pollution control, Water use, Water reuse, Water conservation, Conservation, Chemical wastes, Wool, Biological wastewater treatment, Process control.

Textile manufacturing facilities were studied to develop effluent limitations for existing point sources, standards of performance for new sources, and pretreatment standards for existing and new sources. The industry was divided into several subcategories: wool scouring, wool finishing, low water use processing, woven fabric finishing, knit fabric finishing, carpet finishing, stock and yarn finishing, nonwoven manufacturing, and felted fabric processing. Raw wastewater characteristics vary widely among the categories and also within each category, depending on raw materials and process control. Of 123 toxic pollutants, only 22 were not present or suspected to be present in textile mill wastewaters. Data are listed for analyses of toxic pollutants in the water supply and in treated effluents. The following wastewater constituents were designated as subject to limitation under BPT, BAT and NSPS as appropriate: BOD, total suspended solids, pH, total chromium, COD, phenols, and sulfide. In-plant controls and process changes suitable for pollution control include water reuse, water use reduction, chemical substitution, and material reclamation. Available wastewater treatment technologies are described in detail.
W86-00207

OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS, AUGUST, 1981-OCTOBER, 1982: CITATIONS FROM THE NTIS DATA BASE.
National Technical Information Service, Springfield, VA.
For primary bibliographic entry see Field 5D.
W86-00215

RESTORATION OF HABITATS IMPACTED BY OIL SPILLS.
For primary bibliographic entry see Field 5C.
W86-00239

RECOVERY AND RESTORATION OF ROCKY SHORES, SANDY BEACHES, TIDAL FLATS, AND SHALLOW SUBTIDAL BOTTOMS IMPACTED BY OIL SPILLS,
Stockholm Univ. (Sweden). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W86-00240

EFFECTS OF OIL ON SEAGRASS ECOSYSTEMS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5C.
W86-00241

RECOVERY AND RESTORATION OF SALT MARSHES AND MANGROVES FOLLOWING AN OIL SPILL,
Research Planning Inst., Inc., Columbia, SC.
For primary bibliographic entry see Field 5C.
W86-00242

MEASUREMENTS OF DAMAGE, RECOVERY, AND REHABILITATION OF CORAL REEFS EXPOSED TO OIL,
Continental Shelf Associates, Inc., Boulder, CO.
For primary bibliographic entry see Field 5C.
W86-00243

FISHERIES RESOURCE IMPACTS FROM SPILLS OF OIL OR HAZARDOUS SUBSTANCES,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5C.
W86-00244

LEACHATE FROM HAZARDOUS WASTES SITES,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W86-00247

PLANNING GUIDE FOR EVALUATING AGRICULTURAL NONPOINT SOURCE WATER QUALITY CONTROLS,
Cornell Univ., Ithaca, NY.
P. D. Robillard, M. F. Walter, and L. M. Bruckner.
EPA-600/3-82-021, September 1982. Environmental Research Laboratory, Athens, GA. 733 p, 33 Fig, 22 Tab, 23 Refs, 6 Append. Contract/Grant No. R804925010.

Descriptors: *Water quality control, *Water pollution sources, *Fate of pollutants, *Agriculture, *Nonpoint pollution sources, Planning, Pollution load, Nitrogen, Phosphorus, Sediment, Animal wastes, Salinity, Nutrients, Farm management, Farm wastes, Insecticides, Pesticides, Fertilizers, Irrigation, Eutrophication, Soil conservation, Sediment transport, Erosion control, Cover crops, Terracing, Economic aspects, Honey Creek, Ohio, Yakima River, Washington, Cornell Nutrient Simulation Model, Model studies.

This is a manual for evaluation and selection of agricultural nonpoint source controls for irrigated and nonirrigated cropland. The methodology applies to areas ranging in size from an individual farm to a large region. Agricultural practices and their impacts on water quality are described. Pollutants of concern are nitrogen, phosphorus, sediment, animal wastes, and salinity. Pollution control measures involving tillage methods, cropping practices, and methods of fertilizer and pesticide application are divided into three groups: structural, vegetative, and managerial. The evaluation methodology consists of several steps: (1) description of the watershed, (2) identification of the problem, (3) determination of applicable control measures, (4) choice of the unit of analysis, (5) establishment of the base condition, (6) evaluation of control measures, and (7) development of an optimal control strategy. The methodology is demonstrated with two examples: an individual farm in the Yakima River basin, Washington, and the Honey Creek, Ohio, watershed. The six appendixes, comprising 600 pages of the manual, concern sediment and nutrient loadings from nonirrigated croplands, sediment and nutrient loss from irrigated agriculture, salinity control, water quality problems related to animal agriculture, insecticide use, and economic perspectives of nonpoint source water quality management.
W86-00260

WINTER EVALUATION OF OIL SKIMMERS AND BOOMS.
Environmental Protection Service, Ottawa (Ontario).
Report EPS 4-EP-84-1, February 1984. 109 p, 39 Fig, 17 Tab, 7 Ref, 3 Append.

Descriptors: *Water quality control, *Water pollution control, *Oil recovery, *Cleanup, Oil skimmers, Booms, Oil spills, Little Giant, Destroil, Slicklicker, Skim-Pak, Morris MI-80, Arctic Skimmer, Arctic Marine Oilspill Program, Zoom Boom, Albany Oilfence, Troilboom, Vikoma Seapack, Cold regions.

Five mechanical oil recovery devices (skimmers) and six oil containment barriers were evaluated in Newfoundland and Nova Scotia during March-April 1980. The skimmers varied in size, collection principle, and intended application. Specific comments were given for each. However, some general conclusions were drawn. Only the Destroil and Versatech Arctic Skimmer were deemed capable of surviving moderate sea conditions. Although they can recover a wide range of oils, they would have difficult processing cold Bunker C directly from the water's surface. The Skim-Pak was considered useful for crude oil or low viscosity products in calm water. The Slicklicker, as a shore-mounted unit, was judged useful for handling Bunker C and solids. Little Giant showed promise as a Bunker C recovery device. The Morris MI-80, as presently designed, proved to be too complicated. The U.S. Coast Guard boom proved durable, well designed, and of high quality construction. The AMOP and Zoom booms effectively contained oil; the length of the lower tension member was an important factor. All booms tested were strong enough and durable enough to handle realistic loads.
W86-00290

EUROPEAN AND UNITED STATES CASE STUDIES IN APPLICATION OF THE CREAMS MODEL.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5B.
W86-00294

CREAMS: A SYSTEM FOR EVALUATING MANAGEMENT PRACTICES ON FIELD-SIZE AREAS,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
W86-00295

TING THE APPLICATION OF CREAMS FINNISH CONDITIONS,
onal Board of Waters, Helsinki (Finland).
primary bibliographic entry see Field 5B.
-00296

IRONMENTAL EFFECTS OF NITROGEN TILIZATION EXEMPLIFIED BY OUNDWATER POLLUTION AS SIMULAT-BY CREAMS,
tingen Univ. (Germany, F.R.).
primary bibliographic entry see Field 5B.
-00297

LICATION OF THE CREAMS MODEL CALCULATION OF LEACHING OF NI-TE FROM LIGHT SOILS IN THE NOTEC ER VALLEY,
ute for Land Reclamation and Grassland ing, Raszyn (Poland).
primary bibliographic entry see Field 5B.
-00298

LICATION OF THE CREAMS MODEL: TERN SKANE, SWEDEN,
l Univ. (Sweden). Dept. of Water Resources neering.
primary bibliographic entry see Field 5B.
-00299

DICTING HILLSLOPE RUNOFF AND SION IN THE UNITED KINGDOM: PRE-INARY TRIALS WITH THE CREAMS DEL,
onal Coll. of Agricultural Engineering, Silsoe land).
primary bibliographic entry see Field 5B.
-00300

LICATION OF THE CREAMS MODEL AS T OF AN OVERALL SYSTEM FOR OPTI-ING ENVIRONMENTAL MANAGEMENT ITHUANIA, USSR: FIRST EXPERIMENTS,
anian Research Inst. of Forestry, Vilnius R).
primary bibliographic entry see Field 5B.
-00301

IEW OF CASE STUDIES OF CREAMS DEL APPLICATION,
cultural Research Service, Tifton, GA. South-Watershed Research Center.
primary bibliographic entry see Field 5B.
-00302

WATER RESOURCES PLANNING

Techniques Of Planning

AMIC MODEL FOR MULTIRESERVOIR RATION,
ornia Univ., Davis. Dept. of Land, Air and er Resources.
. Marino, and H. A. Loaiciga.
er Resources Research, Vol. 21, No. 5, p 619-May, 1985. 8 Fig, 5 Tab, 29 Ref. University of ornia, Water Resources Center project AL-WRC-W-634.

criptors: *Model studies, *Reservoir operation, erating policies, *Central Valley Project, ifornia, Planning, Management planning, Hy-lectric power, Electric power production.

ethodology to obtain optimal reservoir oper-policies for a large-scale reservoir system was loped. The model yields medium-term (one-ahead) optimal release policies that allow the ning of activities within the current water with the possibility of updating preplanned ities to account for uncertain events that t the state of the system. River flows are acterized as a multivariate autoregressive process and are forecasted using maximum likelihood estimators. The solution method is a sequential dynamic decomposition algorithm that keeps computational requirements and dimensionality problems at low levels. The model maximizes the system annual energy generation while satisfying constraints imposed on the operation of the reservoir network. Several alternative versions of the model can be used under different assumptions. The model was applied to a large-scale multireservoir system, the northern portion of the California Central Valley Project. The optimal release policies show a potential increase in the system total annual energy with respect to heuristic schedules currently in use. (Author's abstract)
W86-00069

QUADRATIC MODEL FOR RESERVOIR MANAGEMENT: APPLICATION TO THE CENTRAL VALLEY PROJECT,
California Univ., Davis. Dept. of Land, Air and Water Resources.
M. A. Marino, and H. A. Loaiciga.
Water Resources Research, Vol. 21, No. 5, p 631-641, May, 1985. 4 Fig, 3 Tab, 6 Ref.

Descriptors: *Reservoir operation, *Central Valley Project, *California, *Model studies, *Quadratic models, Optimization, Planning, Water management, Reservoir releases, Hydroelectric power.

A quadratic optimization model is applied to the Central Valley Project in California to obtain operation schedules. The model has the minimum possible dimensionality, treates spillage and penstock releases as decision variables and takes advantage of system-dependent features to reduce the size of the decision space. The quadratic optimization model was compared with a linear model. Both models lead to a potential increase in the annual energy production, as was demonstrated for a water year of average streamflow conditions. The quadratic model showed that the Sacramento-San Joaquin Valley agricultural water deliveries can be increased by adopting the optimal release policies. This suggests the possibility of expanding irrigated areas, providing better leaching of agricultural fields, and improving conjunctive management of agricultural fields, and improving conjunctive management of surface and groundwater reservoirs. Although the release policies computed by the quadratic and linear models were similar, there are reasons for preferring the quadratic model. First, it leads to problems of lower dimensionality and provides a closer representation of the physical features of the system, particularly with regard to nonlinearities in the objective function and constraints. Second, because of its capability to incorporate spillages explicitly, the quadratic model can handle a reservoir system of more complicated configuration and complex mass balance equation. (Baker-IVI)
W86-00070

APPLICATION OF THE STORM MODEL TO DESIGN PROBLEMS IN SINGAPORE AND IN KAOSIUNG, REPUBLIC OF CHINA,
Camp, Dresser and McKee, Inc., Boston, MA.
B. M. Harley.
In: Proceedings of Stormwater and Water Quality Model Users Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 22-42, 11 Fig.

Descriptors: *Model studies, *Project planning, *Design criteria, *Urban runoff, *Developing countries, *Water supply development, *Sewer systems, Storm runoff, Hydrologic models, Simulation analysis, Wastewater treatment.

Two examples of the application of modified versions of the STORM model are presented. The first application involved a study in Singapore where urban stormwater runoff was to be captured and treated to augment the island's water supply. The STORM model was used to evaluate the basin runoff, to size the diversion/storage/pumping facilities, and to help determine the effective safe yield from the proposed project. The STORM model also enabled the design team to evaluate the effectiveness of the many quantity and quality control options which should be considered during project development. The second application of the STORM model was in the development of design strategies to control heavily contaminated combined sewer overflows to the Jen Ai River of Kaohsiung, Republic of China. The design study was for a series of major combined sewer overflow structures which, in conjunction with a single trunk sewer, will reduce BOD loadings on the river by over 90%. Use was made of the model's ability to simulate the effect of storage and local treatment at each of the control facilities. These two examples demonstrate that models such as STORM can be effectively used in design situations in developing countries.
W86-00086

ATTEMPT TO IMPLEMENT SWMM IN TUNISIA,
Lund Univ. (Sweden).
J. Niemczynowicz.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 43-52, 7 Fig, 5 Ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Hydrologic models, *Urban runoff, *Storm runoff, *Storm water, *Computer models, *Hydrographs, Runoff, Storm sewers, Management planning, Urban hydrology.

To aid the city of Tunis in stormwater management, a cooperative project was undertaken by the Universities of Lund and Tunis to apply the Storm Water Management Model (SWMM) to the city's problems. The project also sought to teach local research personnel how to handle the model. In order to obtain input data for model calibration, rainfall and runoff data from the Guereb-Roriche catchment which covers about 20 sq km, was used. Significant differences between Swedish and Tunisian urban areas coupled with climatic differences caused significant differences in the input parameters of the model. Also a lack of understanding of the 'modeling philosophy' and a lack of trained hydrologists who knew how to run the computer further complicated the use of the SWMM. Despite these problems, it was possible to reproduce the observed hydrographs quite well as long as the areal distribution of rainfall was taken into account.
W86-00087

MODELING WATER DEMANDS.
For primary bibliographic entry see Field 6D.
W86-00270

6B. Evaluation Process

CONDENSED DISAGGREGATION MODEL FOR INCORPORATING PARAMETER UNCERTAINTY INTO MOUTHLY RESERVOIR SIMULATIONS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 2E.
W86-00073

NATIONAL WATER SUMMARY 1983--HYDROLOGIC EVENTS AND ISSUES.
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, D.C. 20402. USGS Water-Supply Paper 2250, 1984. 243 p, 26 Fig, 9 Tab.

Descriptors: *National water assessment, *United States, *State water issues, *Hydrologic events, Water availability, Water quality, Hydrologic hazards, Land use, Institutional arrangements, Water management.

This national summary reviews current hydrologic conditions and recent events in the United States and provides a broad overview of the hydrologic issues facing the Nation. The summary also includes a description of water issues for each State, the District of Columbia, Puerto Rico, the U.S.

Virgin Islands, and the Western Pacific Islands under the jurisdiction of the United States. The State water-issue summaries were prepared by U.S. Geological Survey personnel in each of the States and are based on discussions with more than 130 State and local organizations. Taken together, these State summaries indicate the major similarities and differences in water issues facing different parts of the country. Major issues described include (1) the short-term vulnerability of surface-water supplies and shallow ground-water supplies to drought; (2) concerns about the reliability of water supplies as competition for water increases; (3) declining ground-water levels; (4) control of surface-water pollution, especially nonpoint sources of pollution; (5) contamination of ground-water supplies and the mitigation of existing sources of pollution, such as hazardous-waste sites; (6) the potential effects of acidic precipitation; (7) chronic problems of flooding; (8) the impacts of resource development, such as coal mining and low-head hydropower, on water resources; and (9) the development of water allocation and reallocation procedures. Hydrologic perspectives on these issues are discussed under the headings 'Water availability'; Water quality'; 'Hydrologic hazards and land use'; and 'Institutional and management'. (USGS)
W86-00131

ECONOMIC PERSPECTIVES ON ACID DEPOSITION CONTROL.
For primary bibliographic entry see Field 5G.
W86-00136

ECONOMICALLY RELEVANT RESPONSE ESTIMATION AND THE VALUE OF INFORMATION: ACID DEPOSITION,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
R. M. Adams, and T. D. Crocker.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 35-64, 5 Tab, 37 Ref.

Descriptors: *Cost analysis, *Acid rain, *Air pollution, *Water pollution effects, Precipitation, Economic aspects, Model studies, Mathematical models, Water pollution control, Sulfur oxides, Agriculture, Decision making, Policy making, Regulations, Water quality control.

The response of ecosystems to acid deposition and the applicability of such response measures to economic assessments were reviewed, and a decision theoretic framework was developed. The methods were applied to an agricultural problem using corn, soybeans, and cotton as examples. A numerical example compared four increasingly stringent regulatory policies from no standard (ambient oxidant standard of 0.18 ppm) to 0.08 ppm. Results were considered highly conditional. Any similar empirical assessment of response estimates would benefit from more comprehensive treatment of the economics of commodity demand and supply and better cost data, as well as a more complete statement of the decison making process of regulatory entities.
W86-00139

SCIENTIFIC TRUTHS AND POLICY TRUTHS IN ACID DEPOSITION RESEARCH,
Wyoming Univ., Laramie. Dept. of Economics.
T. D. Crocker.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 65-79, 36 Ref.

Descriptors: *Cost analysis, *Acid rain, *Air pollution, Precipitation, *Water quality control, Economic aspects, Social aspects, Policy making.

The tradeoff of one set of socially nonoptimal biases in emitter and receptor behavior against another set implies that the total social costs of acid depositions may be nonmonotonic in the combination of the receptors' share of a realized environmental impact and in the critical values policymakers and researchers use to reject or to fail to reject hypotheses about cause-effect of source-cause linkages. For example, if emitters know they will be made responsible for only a minor portion of the cost consequences of a realized enviromental impact, a relatively coarse test for failing to reject either of the aforementioned linkages may have less total social cost than does a more discriminating test; the lesser emitter responsibility generates fewer emitter costs, while the less stringent critical values favor receptors. All this presumes that emitters and receptors perceive their interactions with the policymaker as being contingent on less-than-complete policymaker knowledge of cause-effect and source-cause linkages. The policymaker's choices of target levels for environmental response and emission controls, and the receptors' share directly influence emitter and receptor incentives and thus the total social costs of their activities. In a stochastic world in which emitters do not have to bear the full cost consequences of their activities, scientifically less-than-ideal hypothesis test procedures can desirably alter emitter and receptor investment incentives. Very lenient criteria for failing to reject the results on environmental impacts embodied in scientific reports can reduce the total social costs of acid deposition and their control. This result in no way depends on costly information acquisition for control costs or environmental impacts.
W86-00140

NORMATIVE ECONOMICS AND THE ACID RAIN PROBLEM,
Oklahoma Univ., Norman. Div. of Economics.
L. S. Eubanks, and R. A. Cabe.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 81-96, 17 Ref.

Descriptors: *Cost analysis, *Acid rain, *Air pollution, Precipitation, Economic aspects, Water pollution control, Decision making, Policy, Water quality control, *Normative economics, Alternative planning, Planning, Legal aspects, Philosophy.

The scope of normative economics is limited in a way that excludes arguments that favor or oppose specific criteria for judging optimality. Politicians and philosophers are regarded to have expertise to make such arguments. It is unfortunate that standard practice of normative economics is almost exclusively associated with the study of only one criterion, the efficiency criterion. The implication of this is that normative economics as practiced has a very limited normative basis. This conclusion is illustrated clearly when a number of contributions to the philosophy literature are examined. It is not suggested that normative economics is of little use in policymaking, only that the self-delimited scope of normative economics should be understood in its proper perspective. The practice of normative economics has not been entirely true to its traditional definition because it is seldom interested in the study of criteria posing as alternatives to the criterion of efficiency. Certainly there is an enormous amount of interesting normative economic analysis, as traditionally defined, concerning alternative normative criteria. Normative economic analysis certainly has relevance to policymaking with respect to environmental problems such as acid rain, but perhaps only if it remains true to its defined scope and allocates its effort to the analysis of a much larger set of criteria for evaluating desirable resource uses. (Author)
W86-00141

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WATER UTILITY OPERATING DATA: AN ANALYSIS,
Ames, IA.
For primary bibliographic entry see Field 6D.
W86-00004

EFFECT OF GLOBAL OPTIMIZATION ON LOCALLY OPTIMAL POLLUTION CONTROL: ACID RAIN,
West Virginia Univ., Morgantown. Dept. of Economics.
S. Atkinson.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 21-33, 5 Tab, 11 Ref.

Descriptors: *Cost analysis, *Acid rain, *Air pollution, *Water quality control, Precipitation, Economic aspects, Model studies, Mathematical models, Water pollution control, Sulfur oxides, Ambient least-cost control, State Implementation Plans, Fate of pollutants, Cuyahoga County, Cleveland, Ohio.

The use of ambient least-cost systems (ALC) offered substantial savings over the State Implementation Plans (SIP) in attaining compliance with ambient air quality standards with respect to acid emissions from powerplants. Using data on a set of 25 sulfur dioxide sources in Cuyahoga County in the Cleveland region of the Ohio River Basin, mathematical modeling showed that the substantial cost savings of the ALC strategy over the SIP strategy (about $14 million) was largely due to the long-range transport of locally generated sulfur dioxide. When constraints on sulfur oxide transport were introduced, the cost savings (about $2.5 million) of the ALC strategy were almost neutralized. The question was raised whether the remaining differential was substantial enough to cover the additional administrative costs of the ALC system and outweigh concerns about equity losses.
W86-00138

ECONOMIC IMPACT OF ACID PRECIPITATION: A CANADIAN PERSPECTIVE,
Oklahoma Univ., Norman. Div. of Economics.
B. A. Forster.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John Teasley. p 97-121, 3 Fig, 2 Tab, 49 Ref.

Descriptors: *Water pollution effects, *Acid rain, *Air pollution, Precipitation, *Economic aspects, Ontario, Canada, Lakes, Fishing, Recreation, Taxes.

This paper reviews (1) economic theory relevant to controlling transboundary air pollution and (2) knowledge on the dose-response relationship between acid deposition and physical impacts in the natural environment. This is related to the potential economic significance of acid deposition in eastern Canada. In agriculture and forestry the available dose-response information is insufficient or inconclusive to estimate monetary values with confidence. Aquatic effects of acid deposition are better understood than most other effects. In Ontario, 48,000 lakes are considered sensitive to acidification, which could impact sport fishing, an important component in the province's tourism and recreation industry. Intangible aspects of the environment may also be affected. The increased uptake of mercury by fish in acidified waters also poses a health risk to persons who consume the fish. A survey of taxpayers' willingness to pay additional taxes to improve the environment at different levels is as yet incomplete. This uses levels of environmental conditions rather than dollar amounts of damages.
W86-00142

ACIDIFICATION IMPACT ON FISHERIES SUBSTITUTION AND THE VALUATION OF RECREATION RESOURCES,
Clarkson Univ., Potsdam, NY. Dept. of Economics.
For primary bibliographic entry see Field 5
W86-00144

ANSFERABLE DISCHARGE PERMITS AND OFIT-MAXIMIZING BEHAVIOR,
oming Univ., Laramie. Dept. of Economics.
r primary bibliographic entry see Field 5G.
6-00145

D. Water Demand

TER UTILITY OPERATING DATA: AN ALYSIS,
es, IA.
F. Seidel.
rnal of American Water Works Association, l. 77, No. 5, p 34-41, May, 1985. 1 Fig, 12 Tab, Ref.

scriptors: *Utilities, *Surveys, Water demand, ter distribution, Municipal water, Costs, Rural as.

a analyses of data gathered in AWWA surveys 1976, 1978, and 1980 are simple - consisting narily of means, medians, and frequency distri- ions for common water utility parameters. ter use in gallons per capita per day (liters per ita per day) was on a stable plateau from 1970 980, with mean and median values of about 160 150 gpcd (606 and 568 L/d per capita), respec- ly. Analysis of rural water districts as a sepa- e class was made possible for the first time by ir increased participation in the 1980 survey. eir per-capita water use was somewhat less than t of similar municipal utilities, whereas their es were from one third higher to double, de- ding on the size of the rural district. For munic- utilities, water rates essentially doubled from 0 to 1980, but this was still not enough to keep with inflation during the decade. (Author's tract)
6-00004

BLIC WATER SUPPLIES IN GLOUCESTER UNTY, N.J.,
ny Engineer Waterways Experiment Station, cksburg, MS. Hydraulics Lab.
primary bibliographic entry see Field 2F.
6-00174

ESENT AND PROSPECTIVE USE OF TER BY THE MANUFACTURING INDUS- IES OF NEW JERSEY,
nois State Geological Survey Div., Champaign. Grossman, and A. L. Sherman.
ter Resources Circular 11, June 14, 1963. 12 p, ab, 5 Exhibits.

scriptors: *Water demand, *Water use, *Popu- on dynamics, *New Jersey, *Future planning, ter requirements, Human population, Surveys, ter resources development.

e industries of New Jersey are increasing their of publically supplied water. Planning for ter requirements at least 20 yr in advance of ual need is recommended. In order to obtain, ord and report data concerning water use by ustry, a procedural manual should be prepared taining questionnaires for industries and manag- of public supplies. A study of water use by all nts employing over 250 people is recommended calendar year 1962. In addition, a survey of ter use by all plants in one small New Jersey nty is suggested. Population studies of New sey predicted an abnormally high increase in ulation in the suburban municipalities. Studies employment showed that manufacturing, which he principal industry of New Jersey, employs % of all those employed and uses about 90% of water used by all industry.
6-00175

OUNDWATER MANAGEMENT STRATEGY R MICHIGAN: ECONOMIC AND SOCIAL PACTS OF GROUNDWATER CONTAMINA- ON; A CASE STUDY IN EAST BAY TOWN- IP, GRAND TRAVERSE COUNTY, MICHI- N.
rthwest Michigan Regional Planning and Development Commission, Traverse City.
For primary bibliographic entry see Field 5C.
W86-00218

WATER AND THE CITY,
Lund Univ. (Sweden). Dept. of Water Resources Engineering.
G. Lindh.
United Nations Educational, Scientific and Cultural Organization, Paris, France. 1983. 54 p.

Descriptors: *Urbanization, *Water demand, *Economic development, *Social impact, *Agriculture, Irrigation, Wastewater treatment, Water treatment, Planning, Environmental effects, Water supply, Water use, Saline soils, Groundwater, Rivers, Wells, Vegetation, Runoff, Urban runoff, Urban drainage, Floods, Subsidence, Storm water, Recharge, Public health, Combined sewers, Water transfer, Desalination.

This booklet traces the relationships between water and urban society from primitive times to the present and highlights some of the problems in water supply and quality. One of the major turning points in human history was irrigation, which was the beginning of food surpluses and the progression from farm to village to town to city to metropolis. In many regions of the world a water-demanding society has exploited water resources so that development costs rise dramatically. Early cultures, with few exceptions, have developed along rivers in Egypt, Mesopotamia, India, and China. However, some scholars postulate that water scarcity led to technological advances and improved agricultural practices. History records soil salination, pollution of watercourses with sewage and industrial wastes and other problems. The impact of city growth on water quantity and quality has increased with the size of cities and the loss of open land to building and paving. Urban flooding is an especially serious problem, destroying property and carrying pollutants. Water supply and wastewater treatment in developing countries and industrial regions are described. Examples of solutions are water transfer, reservoirs, seawater distillation, and individualized waste treatment and water pollution prevention schemes. As water demand increases, land subsidence and salt water intrusion increase. The importance of water planning and management is emphasized.
W86-00264

MODELING WATER DEMANDS.
Academic Press, New York, NY. 1984. J. Kindler and C.S. Russell, editors. 248 p, 205 Ref.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, *Municipal water, Economic aspects, Water management, Water requirements, Forecasting, Water supply, Water policy, Regional planning, Industrial water, Agriculture, Linear programming, Statistical models, Mathematical models.

This book presents the basic concepts and techniques of water demand modeling. Several case studies undertaken by the International Institute for Applied Systems Analysis are given. Most planning is based on demand (price dependent water use) rather than on requirement (irreducible water use). Statistical or engineering approaches to modeling are described, and examples of both are given. Modeling techniques are applied to three aspects of water use: industrial, agricultural, and municipal. Modeling is extended to the regional and national levels. Difficulties with the national-level models are highlighted. However, they can provide enough information to avoid truly enormous mistakes in water management, for example, an unnecessary interregional water transfer.
W86-00270

WATER DEMAND,
B. T. Bower, J. Kindler, C. S. Russell, and W. R. D. Sewell.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 1-22, 6 Fig, 1 Tab.

Descriptors: *Planning, *Water demand, *Water use, *Prices, *Model studies, Economic aspects, Water management, Water requirements, Elasticity of demand, Water quality, Water rates, Water policy, Water supply, Consumptive use.

The introductory chapter to the book, 'Modeling Water Demands,' defines the water demand problem and introduces relevant terms. Some functions of water resources management are planning, design, construction, and operation. Analyses of water use problems are divided under three headings: (1) baseline forecasting, (2) predicting impacts of direct policy intervention and indirect impacts of related policies, and (3) balancing use and supply. Several terms used in the analysis of water demand are defined. Demand and requirement are often used interchangeably. However, demand denotes the willingness of consumers to purchase a product, depending on the price; requirement means the quantity purchased regardless of price. Elasticity of demand is the percentage by which the quantity demanded changes for a 1% change in the price. The price of water may be determined by the interaction of supply and demand or through administrative decisions. Six dimensions of water demand are mentioned; these include withdrawals, gross water used, consumptive use, discharge, wastewater services demanded, and time patterns for the preceding dimensions. Water demand also has temporal variation--day to day, seasonally, and year to year.
W86-00271

METHODOLOGICAL FRAMEWORK,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
J. Kindler, and C. S. Russell.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 23-50, 4 Fig.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, Economic aspects, Water management, Water requirements, Linear programming, Water supply, Statistical models, Mathematical models.

Two types of water demand modeling are described--statistical and engineering. The statistical approach views an activity (example, steel mill) as a black box with inputs and outputs, not considering the processes occurring within the activity. The engineering approach details the activity with individual unit processes. Modeling by the statistical approach involves several steps: choosing the model structure, i.e., selecting variables and hypothesizing structural relationships; choosing functional forms; estimating model parameters; verifying and validating the model; and using the model. Mathematical programming can be applied to the engineering approach. Linear programming is shown as an example. Whichever approach is used, the model is verified and validated. Verification is the determination of whether or not the correct model has been developed from a given single set of data describing water demand relations. Validation is testing of the model against one or more independent sets of data. Choice of model type depends on data availability, skills and interests of the modeling team, available computational facilities, and the intended application.
W86-00272

INDUSTRIAL WATER DEMANDS,
Operational Economics, Inc., Houston, TX.
J. C. Stone, and D. Whittington.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 51-100, 9 Fig, 3 Tab.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, *Industrial water, *Pulp and paper industry, *Electric power industry, Economic aspects, Water management, Water requirements, Linear programming, Water supply, Statistical models, Mathematical models, The Netherlands, Poland, Prices, Cooling water.

Two approaches to modeling industrial water demand relationships are discussed and illustrated. The statistical approach is used to model demands for the Dutch paper industry. It focused on estimating water demand relationships and gives a list

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of some econometric problems most likely to be encountered. Statistical estimation in the industrial water sphere is in its infancy. Problems include small sample sized available, lack of necessary data, and the simultaneous determination of price and quantity of water. The mathematical programming approach is illustrated wtih a determination of the water demand for electricity generation in Poland. The discussion includes a general description of the structure and components of the mathematical model, the process of model construction and specification, and model use and results.
W86-00273

AGRICULTURAL WATER DEMANDS,
I. V. Gouevsky, and D. R. Maidment.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 101-147, 16 Fig, 5 Tab.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, *Agriculture, *Irrigation, Livestock, Cattle, Economic aspects, Water management, Water requirements, Linear programming, Water supply, Mathematical models, Crop production, Bulgaria, Wheat, SWIM 2 model.

Agricultural water demands in crop production and livestock production are individually discussed. Water demands of individual and regional agricultual activities are considered, using as an example a linear programming model with a one type crop (wheat), one type animal (cattle) system. Among the information that can be derived from this simple example are the demand function for total irrigation water withdrawals and the demand function for wastewater discharges. The water demands of a large agroindustrial complex in the Silistra region of Bulgaria is analyzed and forecasted using the SWIM 2 model.
W86-00274

MUNICIPAL WATER DEMANDS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Applied Economics.
S. H. Hanke, and L. de Mare.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 149-169, 3 Fig, 8 Tab.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, *Municipal water, Industrial water, Water loss, Malmo, Sweden, Statistical models, Economic aspects, Water management, Water requirements, Elasticity of demand, Water rates, Water supply, Prices.

Municipal water uses may be grouped into six categories, based on the volumes of water and wastewater involved and the timing of their use. The categories are residential, industrial, commercial transportation, public, and lost and unaccounted for water. Residential water use may be over half of total municipal use in many communities. Statistics on mean residential water use for different activities, in different types of residences, and diurnal patterns are presented. Commercial water use is variable--20-55 liters per employee-day in offices, 100 liters per employee-day in businesses with dirty conditions, and up to 1900 liters per day per washing machine in a laundry. Water use in public service activities are 630 liters per day per patient in a hospital, about 300 liters per day per patient in psychiatric facilities and nursing homes, 55-75 liters per day per student in schools with showers and cafeteria, and up to 200 liters per day per user in swimming pools. Leakage and undermetering are responsible for much lost and unaccounted for water, up to 50% in some systems. Statistical methods have proved more suitable for modeling municipal water demands than the engineering approach. An example of statistical modeling is given for residential water demand in the city of Malmo, Sweden.
W86-00275

PROGRAMMING MODELS FOR REGIONAL WATER DEMAND ANALYSIS,
Resources for the Future, Inc., Washington, DC.
C. S. Russell.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 171-206, 11 Fig, 3 Tab.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, *Regional planning, Delaware Valley, Statistical models, Economic aspects, Water management, Water requirements, Industrial water, Water quality, Wastewater treatment, Water supply, Estuaries, Mathematical models, Linear programming.

The design and construction of regional water demand models uses mathematical programming models of individual water use activities, such as industrial, agricultural, and municipal. Since regional models can easily become enormous and complicated, techniques for size reduction and simplification are given. A regional modeling project involving the lower Delaware Valley is used as an example. Although it deals only with water quality and not quantity, many of the principles of model design and size reduction are illustrated. Since each region is unique, models must be custom-built. A handbook which combines standardized parts to produce a regional model is not yet available.
W86-00276

NATIONAL PERSPECTIVE IN WATER DEMAND MODELING,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
J. Kindler, and C. S. Russell.
In: Modeling Water Demands, Academic Press, New York, NY. 1984. p 207-219, 3 Fig, 2 Tab.

Descriptors: *Planning, *Water demand, *Water use, *Model studies, *Municipal water, Economic aspects, Water management, Water requirements, Forecasting, Water supply, Water policy, Regional planning.

Attempts to apply the concept of water demand to the national level are difficult and of limited relevance. Most work has been directed toward use rather than demand. Baseline forecasting, usually undertaken to identify problems before the crisis stage, is not too effective on a national basis. To get the best results, forecasting should be done on a regional basis with some consideration of upstream/downstream relations. Several national water studies are described. Poland has a long history of national water studies dating to 1953-56. A macro interregional linear programming model U.S. agriculture provides much information on least-cost distribution of agricultural production. A water use forecasting study done in Japan in the 1970s has five major components: a macroeconomic model-input-output model and four submodels (municipal, household, industrial, and agricultural). When national aggregated projections of water use are made, several problems develop. Possible intraregional problems are understated or eliminated. The models also overstate net withdrawal totals by ignoring reuse. If the water use exceeds the supply on a national basis, large and wasteful water supply projects or irrigation projects are often conceived without regard to regional conditions.
W86-00277

6E. Water Law and Institutions

NATIONAL WATER SUMMARY 1983--HYDROLOGIC EVENTS AND ISSUES.
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6B.
W86-00131

ACID RAIN: DOES SCIENCE DICTATE POLICY OR POLICY DICTATE SCIENCE,
Georgia Univ., Athens. Inst. of Natural Resources.
J. L. Regens.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 5-19, 2 Tab, 48 Ref.

Descriptors: *Policy making, *Acid rain, *Water quality control, *Air pollution, Precipitation, Fallout, Monitoring, Sulfur oxides, Fate of pollutants, Model studies, Research priorities, Water pollution effects, Environmental effects, Economic aspects, Decision making, Public policy, Water pollution control.

Research can contribute significantly to reducing the current level of uncertainty about the causes and consequences of the acid deposition problem However, science can never provide the last word with absolute certainty. Clearly, such a mission represents an impossible task, although research can be used to improve significantly the quality of information in areas important for decision-makers. Enhanced understanding of the causal factors and potential consequences of acid deposition enables policymakers to identify and select those courses of action which, given their own value systems, address most appropriately the problem. Thus, science neither dictates the policy nor policy the science. Instead, a symbiotic relationship exists between the two. Knowledge from one domain can foster choice in the other. (Author)
W86-00137

LEGAL, ETHICAL, ECONOMIC AND POLITICAL ASPECTS OF TRANSFRONTIER POLLUTION,
Resources for the Future, Inc., Washington, DC.
A. V. Kneese, and R. C. D'Arge.
IN: Acid Precipitation Series, Volume 8: Economic Perspectives on Acid Deposition Control, Butterworth Publishers, Boston. 1984. Volume edited by Thomas D. Crocker. Series edited by John I. Teasley. p 123-133, 1 Tab, 13 Ref.

Descriptors: *Political constraints, *International agreements, *Water pollution effects, Economic aspects, Legal aspects, Ethics, Efficiency, Jurisdiction, Liability, Negotiations.

Compensated and uncompensated transnational pollution problems have been analyzed. Compensation among nations is necessary to achieve economic efficiency, in that costs and benefits will be adequately compared. For many Western ethical criteria, uncompensated risks imposed by one nation on others could be unethical, but this depends on the ethical criterion as well as differences in income and other political considerations. Because of differences in the mix of ethical beliefs among nations along with the desire to maintain national sovereignty, no all-inclusive principle is likely to emerge to solve transnational pollution problems. What is likely to emerge is a sequence of relatively unique solutions that blend economic necessity with political cunning and goodwill. However, the first step appears to be that every nation agrees to negotiate in good faith toward a solution of transnational pollution provided there is sufficient evidence of economic benefit and cost. The record on international settlement of transnational pollution does not lead to a clear and concise set of guiding international principles. The various cases demonstrate the various possibilities ranging from full costing to victim pays. It is unlikely that such piecemeal solutions will lead to economic efficiency in a global sense. Yet, as long as there are gains from trade, including pollution, among nations, and these gains from trade are negotiated over and obtained, everyone should be as well off or better than without negotiation. (Author)
W86-00143

SURVEY OF NATIONAL AND STATE REGULATORY AGENCY POLICY AND PROCEDURES FOR THE DETERMINATION OF THE TOXICITY OF WASTEWATER EFFLUENTS.
Ecological Analysts, Inc., Sparks, MD.
API Publication 4353, American Petroleum Institute, Washington, DC., November 1982. 133 p, 1 Fig, 7 Tab, 6 Ref, 2 Append.

Descriptors: *Toxic wastes, *Public policy, *Water pollution effects, *Standards, *Wastewater management, *Toxicity, *Industrial wastes, Bioassay, Aquatic animals, Permits, State jurisdiction, Regulations, Oil refineries, Water policy, Surveys.

The U.S. EPA and state regulatory agencies use effluent toxicity testing on a case-by-case basis to

aluate the acute toxicity of effluents. It appears ely that effluent toxicity testing, especially given activities in U.S. EPA Region VI, and other ter quality-based regulatory procedures will be ed in upcoming years to help evaluate point irce industrial discharges. The extent and degree which this occurs will depend on the direction l guidance developed by U.S EPA in Washing-, D.C., the specific U.S. EPA regional offices, l the individual states. Since use of effluent icity testing during the issuance of the second nd of NPDES permits is dynamic, status of luent toxicity testing in each state should be efully investigated before making final environ-ntal management decisions. (Author)
6-00211

ATER AND THE CITY,
nd Univ. (Sweden). Dept. of Water Resources gineering.
r primary bibliographic entry see Field 6D.
6-00264

PPORTUNITIES TO PROTECT INSTREAM OWS IN ALASKA,
R. White.
ailable from the National Technical Information rvice, Springfield, VA 22161 as PB83-124974. VS/OBS-82/33, July 1982. Fish and Wildlife rvice, Washington, DC. Office of Biological rvices. 30 p, 2 Tab, 45 Ref. Contract/Grant No. 16-009-79-100.

scriptors: *Water law, *Water policy, *Alaska, ater management, *Rivers, Instream flow, Fish, uatic life, Rivers, Resources management, ter use, Appropriation, Legal aspects, Legisla-n, Water rights, Permits, Land acquisition, ldlife, Water resources.

is report, intended for the use of planning and nagement personnel, identifies and describes mising opportunities for protecting instream s of water under existing Alaskan law. It is igned as a guide through the Federal and state tutes and administrative practices. Sections in-de Department of Natural Resources conditions appropriative rights, reservation of instream ws, Department of Fish and Game acquisition of d and water, anadromous fish permits, pollution s, municipal condemnation, Renewable Re-rces Fund, coastal zone management, Marine heries Compact, and Public Trust Doctrine.
6-00280

'. Nonstructural Alternatives

OOD DAMAGE ALLEVIATION IN NEW RSEY,
my Engineer Waterways Experiment Station, cksburg, MS. Environmental Lab.
Dola.
ter Resources Circular 3, New Jersey State pt. of Conservation and Economic Develop-nt, 1961. 20 p, 22 Ref.

scriptors: *Flood plain zoning, *Flood plain nagement, *Flood control, *Flood damage, ew Jersey, Water resources development, Flood tection, Flood plains, Zoning.

w Jersey is faced with serious flood problems e to increasing population and development in od prone areas such as the Passaic and Dela-re river basins. Only through Federal participa-n in the construction of engineering structures h as dams and local protective works can future od damage to existing developments be reduced. e U.S. Army Corp of Engineers is now compil-data on floods and flood damages to promote ter zoning in the Passaic Valley. The U.S. eather Bureau is conductng flood forecasting in Delaware, Raritan, and Passaic river valleys. e Soil Conservation Service gives technical, st-sharing, and credit aid to local organizations planning and carrying out works of improve-nt for flood prevention, and agricultural and nagricultural water management. The U.S. Geo-ical Survey gathers data on floods by gaging streams throughout New Jersey. The municipal encroachment law permits municipalities to construct improvements, remove obstructions, define the location, establish widths, grades, and elevations of any stream and to prevent encroachments thereon of the flood carrying capacity to be provided. The 1929 Encroachment Law for flood damage alleviation in New Jersey is basically a preventive measure approach. The Tennessee Valley plan for flood plain regulation would divide the responsibility between state and local governments.
W86-00173

6G. Ecologic Impact Of Water Development

REVIEW OF THE EFFECTS OF WATER-LEVEL CHANGES ON RESERVOIR FISHERIES AND RECOMMENDATIONS FOR IMPROVED MANAGEMENT,
Fish and Wildlife Service, Fayetteville, AR. National Reservoir Research Program.
G. R. Ploskey.
Technical Report E-83-3, February 1983. Final Report. U.S Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 83 p, 203 Ref. Intra-Army Order WESRF-82-24.

Descriptors: *Reservoir fisheries, *Fish, *Water level, Water properties, Water level fluctuations, Reservoir releases, Water temperature, Reservoir operation, Ecosystems, Erosion, Turbidity, Chemical properties, Dissolved oxygen, Fish harvest, Nutrients, Flooding, Drawdown, Aquatic plants, Benthos, Spawning, Zooplankton, Literature review.

Information gathered from available literature sources about the physico-chemical and biological effects of water-level changes on reservoir ecosystems is summarized. The effects of variations in both the physical environment (i.e., basin morphometry, bottom substrates and structures, erosion turbidity, temperature, and water-retention time) and the chemical environment (i.e., nutrients and dissolved oxygen) caused by water-level changes on a reservoir's production of fish are described. The complex ways in which water-level changes affect aquatic plants, zooplankton, and the benthos and how these trophic variations can eventually affect the growth, reproduction, and harvest of fish are discussed. The final part of the report summarizes the effects of drawdown and flooding on reservoir fish populations and recommends ways to manage reservoir fluctuation zones by making controllable variables (magnitude, frequency, and timing of water-level change) as favorable as possible for fish survival, spawning, and feeding.
W86-00158

TECHNIQUES TO REDUCE THE SEDIMENT RESUSPENSION CAUSED BY DREDGING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W86-00159

LONG-TERM IMPACT OF DREDGED MATERIAL AT TWO OPEN-WATER SITES: LAKE ERIE AND ELLIOT BAY; EVALUATIVE SUMMARY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5C.
W86-00160

FISHES OF SELECTED AQUATIC HABITATS ON THE LOWER MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
C. H. Pennington, J. A. Baker, and C. L. Bond.
Technical Report E-83-2, January 1983. Final Report. 96 p, 22 Fig, 19 Tab, 39 Ref, Append.

Descriptors: *Environmental effects, *Aquatic habitats, *Fish, *Channel improvement, Mississippi River, Dikes, Stream banks, Banks, Erosion control, Revetments, Bank erosion, Flood control, Habitats, Aquatic animals.

Fish species diversity, abundance, and distribution were studied in four habitats (dike fields, revetted banks, natural banks, and an abandoned river channel) in the Lower Mississippi River near Greenville, Mississippi. The largest number of fish species was found in the dike field habitat (53), followed by the abandoned channel (31), revetted banks (27), and natural banks (24). Dike fields were similar at most sampling periods with respect to species composition but were often different in the relative abundances of the constituent species. The natural banks were generally similar in species composition and relative abundance, while the revetted banks showed greater variability and overall lower similarity. The numerical catch per unit effort was seldom significantly different among habitats. Catches on revetted banks were generally higher than on natural banks. In November 1979 the catch per unit effort was 7 times that of any other habitat. Biomass catch per unit effort was greatest in the revetted bank habitat, followed in order by dike fields, natural banks, and abandoned channel, with two exceptions. In April 1979 the biomass catch per unit effort in the abandoned channel was greater in dike fields and natural banks than in revetted banks; in November 1979 the biomass catch per unit effort was greatest in the abandoned channel. Condition factors were not significantly different among the habitats or seasons. Age 0 fish were abundant in dike fields and, to a lesser extent, in the abandoned channel. Mostly adult fish were collected at natural banks and revetted banks.
W86-00195

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS: THE HERPETOFAUNA OF LAKE CONWAY, SPECIES ACCOUNTS,
University of South Florida, Tampa. Dept. of Biology.
G. T. Bancroft, J. S. Godley, D. T. Gross, N. N. Rojas, and D. A. Sutphen.
Miscellaneous Paper A-83-5, July 1983. Final Report. U.S. Army Aquatic Plant Control Research program, Army Engineer Waterways Experiment Station, 304 p, 62 Fig, 42 Tab, 104 Ref, 2 Append.

Descriptors: *Weed control, *Environmental effects, *Aquatic weed control, *Wildlife, *Lakes, Aquatic animals, *Reptiles, *Amphibians, Snakes, Frogs, Turtles, Fish, White amur, Lake Conway, Florida, Ecosystems, Aquatic habitats, Habitats, Salamanders, Alligators.

Species accounts of the herpetofauna of Lake Conway, Florida, were developed to assess any changes resulting from use of the white amur to control aquatic plants. During 1977-1980 ecological were recorded for 2 of 4 salamanders, all 8 frogs, the American alligator, 5 of 10 turtles, and 1 of 7 snakes. The change most often noticed was a change in relative density, followed by seasonal activity, population structure, open water habitat use, food habits, and movement patterns. No yearly variation was detected in the use of specific littoral zone habitats, growth rates, or reproductive output per individual. The white amur was implicated in ecological changes in 1 salamander and 3 turtle species. This was related to macrophyte removal by the fish, combined with other disturbance phenomena: shoreline development, destruction or removal of individuals from the lake system, boat propeller mortality, investigator efforts, water level fluctuations, and weather conditions.
W86-00202

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER: RIVER MILE 480-530; REPORT 3: BENTHIC MACROINVERTEBRATE STUDIES PILOT REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.

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D. B. Mathis, S. P. Cobb, L. G. Sander, A. D. Magoun, and C. R. Bingham.
Miscellaneous Paper E-80-1, April 1981. Report 3 of a Series. 83 p, 12 Fig, 16 Tab, 8 Ref.

Descriptors: *Environmental effects, *Ivertebrates, *Waterways, *Aquatic habitats, Habitats, Mississippi River, Aquatic animals, Aquatic life, Macroinvertebrates, Benthos, Channels, Dikes, Sand, Banks, Stream Banks, Flow control, Caddisflies, Mayflies, Oligochaetes, Aquatic insects, Insects, Chironomids.

Benthic macroinvertebrates were sampled on the Lower Mississippi River, River Mile 480 to 530. A total of 20,562 organisms, representing 72 distinct taxa, 17 orders, and 5 classes were collected. The three most productive habitats were dike structures (563.4 organisms per rock sample), abandoned channels (70.04 organisms per 0.05 sq m), and natural banks (9.4 organisms per 0.05 sq m). The dike structures contained primarily caddisflies, chironomid larvae, and mayflies. Abandoned channels contained oligochaetes, dipteran larvae, and fingernail clams. Natural banks featured burrowing mayflies and clinging macroinvertebrates. These three habitats were relatively stable compared with the other less productive habitats, dike fields, revetted banks, permanent secondary channel, temporary secondary channel, main channel, and sand bars.
W86-00212

EFFECTS OF BEACH NOURISHMENT ON THE NEARSHORE ENVIRONMENT IN LAKE HURON AT LEXINGTON HARBOR (MICHIGAN),
Coastal Engineering Research Center, Fort Belvoir, VA.
R. T. Nester, and T. P. Poe.
Miscellaneous Report No. 82-13, November 1982. 56 p, 5 Fig, 10 Tab, 17 Ref, 5 Append. Project No. G31533.

Descriptors: *Environmental effects, *Erosion control, *Beaches, *Shore protection, *Lakes, Lake Huron, Lexington Harbor, Michigan, Benthos, Invertebrates, Fish, Water quality, Protection, Dredging, Bottom sediments, Suspended sediment, Turbidity.

A beach nourishment project at Lexington Harbor, Michigan, had no significant adverse effect on the nearshore aquatic environment, as determined by aerial photography, water analysis, and sampling of lake bottom sediments, macrozoobenthos, and fish. However, the beach face profile changed markedly during the 14-month study. By the end of the study, a moderate lakeward extension of the beach face was present in the area immediately south of the harbor.
W86-00224

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER: RIVER MILE 480-530; REPORT 6: LARVAL FISH STUDIES PILOT REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
H. L. Schramm, and C. H. Pennington.
Miscellaneous Paper E-80-1, April 1981. Report 6 of a Series. 74 p, 4 Fig, 29 Tab, 10 Ref.

Descriptors: *Environmental effects, *Aquatic habitats, *Fish, *Waterways, Habitats, Mississippi River, Aquatic animals, Aquatic life, Larvae, Channels, Dikes, Sand, Banks, Stream banks, Flow control, Oxbow lakes, Sampling, Diurnal distribution, Herring, Carp.

Larval fish were collected in 9 habitats in the Lower Mississippi River during the spawning season. Abandoned channels and oxbow lakes had relatively low diversity and high densities of clupeids and centrarchids. Natural banks and revetted banks had high density and abundance of larval fish. Dike fields had high diversity and moderate density of larval fish. Three of the four main channel sampling stations showed low diversity and density of larval fish. The fourth main channel had high diversity and high density on two sampling dates. In temporary secondary channels the density of larval fish was low and the diversity was high. Both density and diversity were low in the permanent secondary channel and in the sand bar. The number of taxa and the density of larvae were greatest at dusk. Twelve taxa were collected only at dusk, dawn, or at night. Samples taken within a 1- to 2-hour period of a diel cycle did not constitute significant amounts of the variation in number of taxa or density of larval fish. In addition, samples collected with paired nets did not constitute a significant portion of the variation in number of taxa but did constitute a significant portion of the variation in density.
W86-00226

FLOOD CONTROL MINNESOTA RIVER, MINNESOTA, MANKATO-NORTH MANKATO-LEHILLIER: DESIGN MEMORANDUM NO. 8, PART I (LOCATION STUDY).
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 8A.
W86-00238

GUIDE TO STREAM HABITAT ANALYSIS USING THE INSTREAM FLOW INCREMENTAL METHODOLOGY,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
K. D. Bovee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-131052. Report No. FWS/OBS-82/26, June 1982. 249 p, 52 Fig, 31 Tab, 78 Ref, 2 Append.

Descriptors: *Environmental effects, *Streams, *Habitats, *Water analysis, *Aquatic life, Planning, Rivers, Instream Flow Incremental Methodology, Instream flow, Water yield, Sediment yield, Channel flow, Channeling, Water quality, Watersheds, Land use, Aquatic habitats, Aquatic animals, Reservoirs, Fish passages, Channel improvement, Hydrology, Water resources development.

The Instream Flow Incremental Methodology has been expanded and refined to produce an approach to the assessment of riverine habitats and the impact of disturbances on these habitats. The first chapters of this user's guide explain the overall approach of the methodology, describe activities that preceed data collection, show the sequence of data collection, and detail options for preparing, displaying, and interpreting the output. The later chapters contain necessary concepts of hydrology and channel dynamics and the Physical Habitat Simulation System. Stream habitat can be defined in terms of macrohabitat (temperature, water quality, sediment size and load, channel shape, slope, and flow regime) or microhabitat (distribution of depth, velocity, substrate, and cover within a specific area of the stream). Macrohabitat characteristics affect the longitudinal distribution of species and create longitudinal gradations in the microhabitat characteristics along the stream. The total habitat availability at any flow is defined by the area of overlap between suitable macrohabitat conditions and available microhabitat area. Total habitat may be determined with or without a project such as reservoir construction or channel improvement.
W86-00251

NORFOLK HARBOR AND CHANNELS DEEPENING STUDY, REPORT 1: PHYSICAL MODEL RESULTS, CHESAPEAKE BAY HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 2L.
W86-00266

7. RESOURCES DATA

7A. Network Design

SYNTHESIS OF RADAR RAINFALL DATA,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
For primary bibliographic entry see Field 2A.
W86-00084

7B. Data Acquisition

STREX TOVS/RADIOSONDE COMPARISON, PART I: TOVS/AVHRR AND RADIOSONDE INVENTORY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
H. M. Byrne.
NOAA Data Report ERL PMEL-8, October 1982. 135 p, 3 Append.

Descriptors: *Remote sensing, *Satellite technology, *Radiosondes, *Meteorological data collections, STREX, NAVAID, TOVS, AVHRR, Measuring instruments.

This report consists of four appendixes of data generated in 110 overpasses of the NOAA-6 polar orbiter. Appendix A is a catalog of 123 computer-generated coverage maps of the overpasses. They show the coverage of the AVHRR scanner during the pass and the coverage of the TOVS instruments. Appendix B tabulates the STREX NAVAID radiosonde and aircraft dropsonde data taken during the experiment. Appendix C consists of lists of translated passes including orbit number, data, and time, and the archive tape label at the University of Miami. Appendix D is the tabulation of the NAVAID radiosonde computer printouts on microfiche.
W86-00187

ARCTIC MARINE OILSPILL PROGRAM (AMOP) REMOTE SENSING STUDY,
Canada Centre for Remote Sensing, Ottawa (Ontario).
R. A. O'Neil.
Report EPS 4-EC-83-3, March 1983. Environmental Protection Service, Ottawa, Ontario. 257 p, 103 Fig, 6 Tab, 79 Ref, 10 Append.

Descriptors: *Remote sensing, *Satellite technology, *Path of pollutants, *Oil spills, Arctic, Cold regions, Ice, Oil slicks, Canada, Arctic Marine Oilspill Program, Radar, Television, Photography, Infrared imagery, Kurdistan, Nova Scotia, Montreal Harbor, Scott Inlet, Data aquisition.

The Arctic Marine Oilspill Program studied remote sensing of oil slicks on ice-infested waters. Experiments were conducted in Montreal Harbor, Scott Inlet, off the New Jersey coast, and off the Nova Scotia coast (Kurdistan spill). A recommended integrated sensor package included a side-looking radar, an ultraviolet-infrared dual channel line scanner, a laser fluorosensor, a low-light-level television, and annotated photographic cameras. A real-time display system was recommended to allow operator interaction with the sensors.
W86-00258

BOULDER UPSLOPE CLOUD OBSERVATION EXPERIMENT.
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 2B.
W86-00261

USE OF SATELLITE IMAGERY FOR TRACKING THE KURDISTAN OIL SPILL,
Remotec Applications Ltd., St. John's (Newfoundland).
B. R. Dawe, S. K. Parashar, J. P. Ryan, and R. D. Worsfold.
Report EPS 4-EC-81-6, December 1981. Environmental Protection Service, Ottawa, Ontario. 31 p 19 Fig, 3 Tab, 10 Ref.

Descriptors: *Remote sensing, *Satellite technology, *Oil spills, Oil slicks, Kurdistan, Path of pollutants, LANDSAT, TIROS, Ice, Cape Bretor Island, Infrared imagery.

he effectiveness of using satellite imagery in lo-ating, monitoring, and tracking oil spills in open ater was studied after the tanker Kurdistan broke two pieces in ice off Cape Breton Island on larch 15, 1979. The accident released 7000 metric ns of Bunker C oil. Results of the study were conclusive. A major oil slick was located on only ne occasion. At this time only TIROS AVHRR nagery with a reduced dynamic range (2 signifi-nt bits missing) was available. All other TIROS nd LANDSAT data had no confirmed slicks ithin the imaged areas. Sun elevations and wind eeds were unfavorable for detection of oil slicks y satellite imagery. However, LANDSAT data etected a confirmed oil-on-ice slick in Gabarouse ay. Band 4 provided the best contrast, whereas and 7 was the worst. TIROS imagery over an oil-e area did not detect an oil slick.
86-00291

C. Evaluation, Processing and ublication

ONITORING OF RESERVOIR VOLUME SING LANDSAT DATA,
oorkee Univ. (India). Dept. of Earth Sciences.
P. Gupta, and S. Banerji.
ournal of Hydrology, Vol. 77, p 159-170, 1985. 7 g, 1 Tab, 18 Ref.

escriptors: *Reservoir storage, *Remote sensing, Landsat, *Satellite technology, *Ramganga dam servoir, *India, Mountain lakes, Water depth, opography, Lake morphology, Lake morphome-y.

easuring depth of a water body by remote sens-g is limited by several factors such as turbidity, epth of water, type of bedrock material, wave-ngth used, etc. Measurement of width, length and ea of a reservoir can be done rather easily with e help of satellite data. The accuracy of areal timation is limited by the areal resolution of the nsor and topographic milieu. Computing lake rface area for estimating water volumes would ve limited applicability in areas of high topo-aphic relief. A method which was suggested by hers and involves marking of land-water contact m satellite data along low-gradient channels was plied to the Ramganga dam reservoir (Hima-yas, India) using Landsat MSS CCT's, field spec-o-radiometric measurements and theodolite sur-ys. The technique can be utilized in areas of own topography for real-time remote monitor-g of fluctuations in reservoir volume. The eleva-n data obtained are very close to the recorded ater level; taking design data as the standard data ves + or - 0.24% accuracy. For the sake of mparison, an attempt was also made to compute ater volume by measuring lake surface area from e satellite data. The area of the reservoir can be easured upto an accuracy of + or - 5.14%. Some ement of inaccuracy in measuring reservoir sur-ce area could be due to rugged relief and shad-vs. (Collier-IVI)
86-00032

ATER RESOURCES DATA FOR FLORIDA, ATER YEAR 1981 VOLUME 1: NORTHEAST LORIDA.
eological Survey, Orlando, FL. Water Resources iv.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB83-170753. SGS Water Data Report FL-81-1, 1982. 591 p, 34 g, 1 Tab.

escriptors: *Florida, *Hydrologic data, *Surface ater, *Groundwater, *Water quality, Flow rate, aging stations, Lakes, Reservoirs, Chemical anal-es, Sediments, Water temperatures, Sampling es, Water levels, Water analyses, Elevations, ater wells, *Data collections.

ater resources data for the 1981 water year in orida consists of continuous or daily discharge r 279 streams, periodic discharge for 52 streams, ntinuous or daily stage for 64 streams, periodic age for 82 streams, peak discharge for 78 streams d peak stage for 55 streams; continuous or daily elevations for 77 lakes, periodic elevations for 144 lakes; continuous ground water levels for 483 wells, periodic ground water levels for 661 wells, and miscellaneous water level measurements for 2,807 wells; quality of water data for 301 surface water sites and 842 wells. The data for northeast Florida includes continuous or daily discharge for 57 stream, periodic discharge for 6 streams, miscellaneous discharge for 62 streams, peak discharge for 29 steams, low-flow discharge for 2 streams, continuous or daily stage for 28 streams; continuous elevations for 20 lakes and periodic elevations for 30 lakes; continuous ground water levels for 31 wells, periodic ground water levels for 116 wells, and miscellaneous water level measurements for 636 wells; quality of water for 80 surface water sites and for 702 wells. (USGS)
W86-00127

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1982, VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
R. C. Ugland, J. T. Steinheimer, J. L. Blattner, and R. G. Kretschman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-120138. USGS Water Data Report CO-82-2, 1983. 339 p, 6 Fig, 5 Tab. Prepared in cooperation with the State of Colorado and other agencies.

Descriptors: *Colorado, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections, Colorado River basin.

Water-resources data for Colorado for the 1982 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes, and reservoirs, and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for 408 gaging stations, stage and contents of 27 lakes and reservoirs, 6 partial-record low-flow stations, peak-flow information for 30 crest-stage partial-record stations, and 50 miscellaneous sites; water quality for 163 gaging stations and 245 miscellaneous sites; and water levels for 55 observation wells. Nine pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of J. F. Blakey, District Chief. (USGS)
W86-00128

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1981, VOLUME 1. HUDSON BAY BASIN.
Geological Survey, Bismarck, ND. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83 213785. USGS Water Data Report ND-81-1, 1982. 325 p, 7 Fig.

Descriptors: *North Dakota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections, Hudson Bay basin.

Water resources data for the 1981 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. Volume 1 of this report contains 67 gaging stations; stage only records for 6 gaging stations; stage and contents for 4 lakes and reservoirs; water quality for 24 gaging stations; 10 partial-record stations, 14 lakes, 26 wells, and water levels for 19 observation wells. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. (USGS).
W86-00129

WATER RESOURCES DATA HAWAII, OTHER PACIFIC AREAS, WATER YEAR 1981. VOLUME 2. GUAM, NORTHERN MARIANA ISLANDS, FEDERATED STATES OF MICRONESIA, PALAU ISLANDS AND AMERICAN SAMOA.
Geological Survey, Honolulu, HI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83 171116. USGS Water-Data Report HI-81-2, 1982. 148 p, 16 Fig.

Descriptors: *Pacific area, *Hydrologic data, *Surface water, *Groundwater, *Water quality, *Flow rate, Gaging stations, Chemical analyses, Sediments, Reservoirs, Water temperatures, Sampling sites, Water levels, *Data collections.

Volume 2 of water resources data for the 1981 water year for other Pacific areas consist of records of stage, discharge, and water quality of streams; stage of a reservoir; and water levels in wells and springs. This report contains discharge record for 41 gaging stations; stage only record for 2 gaging stations; water quality for 3 gaging stations, 39 partial-record stations; water temperature for 60 gaging stations; and water levels for 10 observation wells. Also included are 47 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. (USGS).
W86-00130

SEDMNT: A SEDIMENT TRANSPORT SUBMODEL BASED ON HYDRODYNAMIC PRINCIPLES FOR THE UNIFIED TRANSPORT MODEL,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2J.
W86-00155

FOUNDATIONS OF PRINCIPAL COMPONENT SELECTION RULES,
Scripps Institution of Oceanography, La Jolla, CA.
R. W. Preisendorfer, F. W. Zwiers, and T. P. Barnett.
SIO Reference Series 81-4, May 1981. 192 p, 37 Fig, 33 Tab, 75 Ref.

Descriptors: *Data processing, *Data interpretation, *Model studies, *Temperature, Air temperature, Meteorology, Principal component analysis, Mathematical studies.

The problem of separating signal from noise in a given space-time data set of geophysical fields which has been rendered into its principal component representation is considered. These separations are effected by two main sets of selection rules: dominant-variance and time-history. The dominant-variance rules are based on the fact that the covariance matrix of the sum of a signal and a noise data set generally have a recognizably different eigenvalue curve than that of each of the two summands so that, under hypothesized noise and sampling conditions, the presence of a signal can be inferred with a chosen level of confidence. The time-history rules are based on the temporal evolution of the given data set's principal component series, and test the hypothesis that the series are of a given noise type. A rejection of the hypothesis about a particular component series at a given level of confidence results in the selection of the principal component as potentially signal-like. Nine dominant-variance rules and eight time-history rules were tested. Methods of interpreting principal component representations of data sets are given. Suggestions are also given for associating possible underlying dynamical models to these representations.
W86-00186

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8. ENGINEERING WORKS

8A. Structures

OPTIMAL URBAN WATER DISTRIBUTION DESIGN,
MacLaren Engineers, Winnipeg (Manitoba).
For primary bibliographic entry see Field 5F.
W86-00071

WEIR JETTY PERFORMANCE: HYDRAULIC AND SEDIMENTARY CONSIDERATIONS, HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
W. C. Seabergh.
Technical Report HL-83-5, March 1983. Final Report. 298 p, 43 Fig, 3 Tab, 59 Photos, 105 Plates, 32 Ref, 2 Append.

Descriptors: *Performance evaluation, *Jetties, *Hydraulic models, Tidal rivers, Sediment transport, Tidal hydraulics, Flood flow, Ebb flow, Sediment control.

This study was performed to quantify the design parameters of an efficient sediment-handling weir jetty system. A 150-ft by 350-ft facility, yielding a 1:100 scale, in which the bay area was either partially filled (low Keulegan K value) of nearly filled (high Keulegan K value), was used to provide extremes of velocity-tidal elevation flow relationships over the weir. Sediment tracers and a movable-bed beach section provided the means to examine the deposition. Results indicate the mean tidal level weir elevation is the most practical elevation for providing wave protection for a dredge, good sediment transport across the weir, and good flood-ebb tidal flow relationships. Strong ebb flow currents over the weir are not desirable as they might aid in migration of the navigation channel through the deposition basin. Jetty systems with the outer, more oceanward portions parallel to each other and at minimum spacing provide the best flow characteristics when tidal current migration through the deposition basin region is considered. Wave-generated currents upcoast of the weir jetty are not entirely captured by the weir but some current, and thus sediment, moves oceanward along the outer portion of the jetty. Also, reflected waves off the jetty and weir structure combine with incident waves to form a short-crested wave field which aids in removal of sediment from the upcoast beach, to various degrees, depending on the structure's angle with respect to the shoreline and the incident wave angle. The effects of groins adjacent to the weir section were examined with regard to providing additional fillet storage and reducing the sediment movement in an oceanward direction along the jetty. Positive results were found for each variation tested.
W86-00152

BARCELONA HARBOR, NEW YORK, DESIGN FOR HARBOR IMPROVEMENTS: HYDRAULIC MODEL INVESTIGATION,
Coastal Engineering Research Center, Vicksburg, MS.
R. R. Bottin.
Technical Report CERC-84-3, August 1984. Final Report. 290 p, 6 Fig, 25 Tab, 134 Photos, 28 Plates, 15 Ref, 3 Append.

Descriptors: *Hydraulic models, *Harbors, *Docks, Wave action, Wave height, Barcelona Harbor.

A 1:60-scale (undistorted) hydraulic model of Barcelona Harbor, New York, including approximately 7,000 ft of the New York shoreline and sufficient offshore bathymetry in Lake Erie to permit generation of the required test waves, was used to investigate the design of certain proposed improvements with respect to wave action. Proposed improvements consisted of: (1) rubble-mound breakwater extensions, (2) rubble-mound absorbers installed along the harbor sides of the existing east and west break-waters and the lakeward face of the city dock, (3) rubble-mound spurs installed southerly of the lakeward heads of the existing breakwaters, and (4) a parapet wall installed on the existing west breakwater. Two 60-ft-long wave generators and an Automated Data Acquisition and Control System were utilized in model operation. An optimum improvement plan was selected based on the results of wave-height tests using monochromatic waves and spectral wave tests.
W86-00157

NAVIGATION CONDITIONS IN VICINITY OF WALTER BOULDIN LOCK AND DAM COOSA RIVER PROJECT: HYDRAULIC MODEL INVESTIGATION,
Geological Survey, Reston, VA.
C. Myrick, and J. J. Franco.
Technical Report HL-84-11, December 1984. Final Report. 129 p, 16 Fig, 5 Tab, 77 Plates.

Descriptors: *Locks, *Navigation, *Hydraulic models, *Model studies, Models, Navigation canals, Navigation obstructions, Simulation analysis, Design criteria, Surges.

The Walter Bouldin Lock will be the first navigation lock proposed for development of navigation on the Coosa River Waterway. The lock will be located in the left overbank area of Walter Bouldin Dam. Three fixed hydraulic models were used to examine navigation conditions in the reach in areas where difficulties were expected. Results showed that no serious navigation problems should arise in the Jordan Reservoir and in the entrance to the diversion canal. Navigation conditions could be hazardous through the Bouldin reservoir when the pool is below elevation 248.00 ft. due to high velocities and crosscurrents. Tows with sufficient power to overcome the high velocity currents could negotiate the powerhouse tailrace and lower lock approach channel without serious difficulties. Lock emptying and start up of powerhouse units would create surges that would be hazardous to navigation within the lock approach channel and in the reach downstream to below the confluence of the tailrace and the Alabama River. Surges hazardous to navigation could also develop when closing down one or more powerhouse units.
W86-00171

NAVIGATION CONDITIONS AT MITCHELL LOCK AND DAM, COOSA RIVER, ALABAMA,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
C. M. Myrick.
Technical Report HL-84-12, December, 1984. Final Report. 70 p, 14 Fig, 9 Tab, 31 Plates.

Descriptors: *Locks, *Model studies, *Design criteria, *Navigation, Structural models, Models, Planning, Structural engineering, Dams, Hydraulic structures, Gates, Hydraulic gates.

A fixed-bed model reproducing about 4 miles of the Coosa River and adjacent overbank areas to an undistorted scale of 1:120 was used to provide data on navigational conditions with the proposed lock (Mitchell Lock). Results of the study showed that with medium to high flows, navigation conditions at the Highway 22 Bridge would be hazardous for both upbound and downbound tows due to the high velocities and limited width provided through the navigation span with the existing piers and low superstructure. With the first and second lock alignments, navigation conditions were acceptable with the 35,000 cu ft/sec flow only. With the third lock alignment, navigation conditions were acceptable for all flows evenly distributed through the gated dam up to and including the 90,000 cu ft/sec flow. Flows unevenly distributed through the gated dam could cause navigation problems in the lower pool. Navigation conditions would be hazardous for tows in the upper lock approach canal during lock filling or at the end of the lower guard wall when emptying the lock into the lower approach with no riverflow. This problem could be eliminated by a riverflow of 35,000 cu ft/sec or by emptying the lock into the river.
W86-00177

PROGRAM CRITERIA SPECIFICATIONS DOCUMENT: COMPUTER PROGRAM TWDA FOR DESIGN AND ANALYSIS OF INVERTED-T RETAINING WALLS AND FLOODWALLS,
Army Engineer Div. Lower Mississippi Valley, Vicksburg, MS.
V. M. Agostinelli, W. A. Price, and C. E. Pace.
February 1981. Final Report. 217 p, 10 Fig, 12 Exhibits.

Descriptors: *Structural engineering, *Soil mechanics, *Computer programs, *Design criteria, *Retaining walls, Walls, Load distribution, Stability analysis, Earth pressure, Soil pressure, Hydrostatic pressure, Seepage, Soil properties, Shear, Friction, Compressive strength, Earthquake engineering, Seismic properties, Water pressure, Reinforced concrete, Concrete, Stress, TWDA program.

This document presents criteria prepared as the basis for developing TWDA (T-wall design/analysis), a computer program for design and analysis of inverted-T cantilever walls founded on earth or rock. These structures can act as floodwalls or retaining walls. The program is a series of design or analysis modules, each performing one specific step. Data are of two types: basic and load case. Stability criteria are the most uncertain and among the most important data used in design of an inverted-T wall. Other criteria are applied pressures (earth, overturning and sliding, hydrostatic, surcharge, and seepage), overturning stability, sliding, bearing pressures, earthquake analysis, and structural design (stress, reinforcing steel, stem loadings).
W86-00193

CLEVELAND HARBOR, OHIO: DESIGN FOR THE SAFE AND EFFICIENT PASSAGE OF 1,000-FT-LONG VESSELS AT THE WEST (MAIN) ENTRANCE, HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Bottin.
Technical Report HL-83-6, March 1983. Final Report. 346 p, 8 Fig, 34 Tab, 170 Photos, 20 Plates, 21 Ref, 2 Append.

Descriptors: *Breakwaters, *Navigation, *Waves, Cleveland Harbor, Ohio, Lake Erie, Model studies, Hydraulic models, Water currents, Channel improvement, Transportation, Ships.

A 1:100-scale hydraulic model of Cleveland Harbor, Ohio, was used to investigate the effects of proposed improvements on ship maneuverability, wave and current action, and river flow conditions. Proposed changes included removal of portions of the existing breakwater spurs, deepening and widening of the existing channel, installation of additional breakwaters, and modifications of existing arrowhead breakwaters. Results indicated that existing conditions are characterized by rough and turbulent waves during storms, making the west entrance unsafe for 1000-ft long ore carriers. For safe passage of the 100-ft ships in fair weather, the east and west breakwater spurs should be reduced in length by 200 ft and 300 ft, respectively. However, this alteration would increase wave heights in the Lakefront Harbor. The optimum crest elevation of the west arrowhead breakwater should be 14 ft (10 ft if the structure is sealed). The optimum plan for severe weather conditions (thus for all wave conditions) consisted of removal of 300 ft of the existing west spur breakwater and 200 ft of the existing east spur breakwater, 1000-ft parallel extension of the east and west arrowhead breakwaters.
W86-00204

CHANNEL CONTROL STRUCTURES FOR SOURIS RIVER, MINOT, NORTH DAKOTA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
P. A. Saunders, and J. L. Grace.
Technical Report HL-81-3, April 1981. Final Report. 57 p, 9 Fig, 1 Tab, 17 Photos, 16 Plates.

scriptors: *Hydraulics, *Erosion control, annels, *Gabions, Riprap, Model tests, Hyulic models, Souris River, North Dakota, Ice, w characteristics, Bank stabilization.

del tests of channel control structures conicted of concrete and gabions were conducted n undistorted scale ratio of 1:12 to determine discharge characteristics of the structures, size extent of riprap required to prevent scour vnstream of the structures, effects of ice flowover the structures, and stability of the gabion ctures. The gabion structure was located in a cal section of trapezoidal channel, and a stable ion configuration was developed by extending gabions farther up the side slopes and farther vnstream of the structure than was indicated in original design. The concrete structure was ed in an expanded section of trapezoidal chanwith riprap protection on the slide slopes and he channel bottom upstream and downstream he structure. Model results indicated that the inal size and extent of protection could be ced without endangering the structure. Free submerged flow discharge characteristics were rmined for both types of channel control struc- s tested, and stability criteria were developed he gabion structures. (Author)
5-00209

CHNIQUE TO OPTIMALLY LOCATE MULEVEL INTAKES FOR SELECTIVE WITHAWAL STRUCTURES,
y Engineer Waterways Experiment Station, ksburg, MS. Hydraulics Lab.
S. Dortch, and J. P. Holland.
hnical Report HL-84-9, November 1984. Final ort. 34 p, 11 Fig, 4 Tab, 5 Plates, 8 Ref, end.

criptors: *Hydraulic structures, *Dams, *Resirs, *Outlets, *Intakes, *Water quality control, mization, Mathematical models, Model studBeltzville Dam, Design criteria.

ystematic procedure is given for designing an mum selective withdrawal intake configuration a reservoir outlet works. A reservoir thermal lation model was coupled with a mathematical mization algorithm to develop the optimal ver- placement of intakes and to minimize the total ber of intakes. The simulation/optimization nique was applied to a specific case: the selecwithdrawal intake structure at Belzville Dam he Pohopoco Creek, Pennsylvania. Two mathtical optimization techniques were tested. The ic coordinate search with the Golden Section search proved more suitable than Powell's iod.
-00213

OD CONTROL MINNESOTA RIVER, NNESOTA, MANKATO-NORTH MANKALEHILLIER: DESIGN MEMORANDUM 8, PART I (LOCATION STUDY).
y Engineer District, St. Paul, MN.
ilable from the National Technical Information ice, Springfield, VA 22161 as ADA-120868. n Street Trunk Highway 60 Bridge over the nesota River between Mankato and North kato. Includes the Draft Supplement to the l Environmental Impact Statement for Bridge ations. June 1981. 294 p, 10 Fig, 13 Tab, 5 end.

criptors: *Hydraulic structures, *Environmenffects, *Bridges, *Flood control, Highways, nesota River, Mankato, Socal impact, Minne-

d control works are being constructed on the nesota and Blue Earth Rivers, Minnesota, to ect developed portions of Mankato, North kato, and Le Hillier from frequent flood age. This report details the engineering studies the modification to the Main Street bridge, ch must be raised or replaced to an elevation of above the existing bridge. The tentative plan ld produce adverse neighborhood impacts in kato.
-00238

WAVE STABILITY STUDY OF RIPRAP-FILLED CELLS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
D. G. Markle.
Miscellaneous Paper HL-83-2, April 1983. Final Report. 59 p, 43 Fig, 1 Tab, 18 Plates.

Descriptors: *Erosion control, *Soil mechanics, *Riprap, *Wave action, *Bank protection, Bank stabilization, Stream stabilization, Hydraulic models, Model studies, Wave runup.

Both two-dimensional and three-dimensional hydraulic model investigations were conducted to test the stability of a new streambank protection concept when exposed to short-period wave attack. The concept, referred to as 'Riprap-Filled Cells,' consists of containerizing riprap in various sizes of cells. Based on the 1:4-scale (model:prototype) model tests and results for the 'riprap-filled cells' placed on IV-on-2H streambank slopes that are assumed to be stable and impermeable and for angles of wave attack of 90, 60, and 30 degrees, it is concluded that: (a) one-ft-cube cells (full and half-full of 0.6- to 4.6-lb riprap) are stable (no streambank exposure) for 2.0-sec, 1.0- to 1.75-ft, 4.0-sec, 1.0- to 3.0-ft, and 6.0-sec, 1.0- to 2.5-ft nonbreaking waves; (b) rectangular cells (half-full of 0.6- to 4.6-lb riprap) are stable for nonbreaking wave heights up to and including 1.5 ft for wave periods of 2.0 and 6.0 sec. Wave heights exceeding this produce spot exposures of the streambank; (c) rectangular cells (full of 0.6- to 4.6-lb riprap) are stable for 6.0-sec, nonbreaking waves up to and including, 2.0 ft. Wave heights exceeding 2.0 ft produced spot exposures of the streambank; (d) both runup and rundown on all sections tested appear to be functions of wave steepness, relative depth, and angle of wave attack. The angles of wave attack, listed in descending magnitudes of runup and rundown produced, are 60, 90, and 30 degrees. One-ft-cube cells, full of riprap, and rectangular cells, half-full of riprap, show trends of decreasing runup and rundown with increasing values of wave steepness and relative depth. Insufficient data are available for these trends to be well defined for the 1-ft-cube cells, half-full of riprap and the rectangular cells, full of riprap. (Author)
W86-00283

8B. Hydraulics

B-JUMPS AT ABRUPT CHANNEL DROPS,
Ecole Polytechnique Federale de Lausanne (Switzerland). Chaire de Constructions Hydraulics.
W. H. Hager.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 861-866, May, 1985. 6 Fig, 7 Ref.

Descriptors: *Hydraulic jump, *Pressure distribution, Channel flow, Channels, Fluid mechanics, Stilling basins, Mathematical equations.

Hydraulic jumps are one of the most frequently used energy dissipators. Its simplest form, the palne hydraulic jump occurs in rectangular, prismatic, and almost horizontal channels. Whenever using hydraulic jumps as a kinetic energy dissipator, one has to control carefully its stability under all possible flow conditions, which may be achieved by stilling basins, by which the jump is forced to appear at a particular location. B-jumps in rectangular, prismatic stilling basins consisting of an abrupt drop of the channel bottom are investigated by accounting for the effective pressure distribution and the internal flow process. The traditional approach is modified to yield a more accurate relation for the conjugate flow depths. An equation is proposed which agrees favorably with observations when the pressure distribution at the drop is properly accounted for. (Baker-IVI)
W86-00018

WATER SURFACE AT CHANGE OF CHANNEL CURVATURE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
P. M. Steffler, N. Rajaratnam, and A. W. Peterson.
Journal of Hydraulic Engineering, Vol. 111, No. 5, p 866-870, May, 1985. 1 Fig, 4 Ref.

Descriptors: *Hydraulic engineering, *Water surface, *Channel flow, *Curves, Froude number, Channels, Model studies, Open channels.

In most work on the problem of flow in curved open channels, the lateral water surface slope has been assumed to be an algebraic function of the local channel curvature. Inspection of experimental water surface profiles indicates that an adjustment length in the order of the channel width is required where the curvature changes abruptly. A simple model is presented for the water surface configuration in the vicinity of an abrupt change in channel curvature taking free surface effects into account. The flow is assumed frictionless and the curvature is assumed mild. A simple expression for the length of such a transition as a function of Froude number has also been presented. The predicted water surface topography was shown to agree reasonably well with a few preliminary experiments. (Baker-IVI)
W86-00019

STORM SEWER OPTIMUM DESIGN,
D. Hoang.
In: Proceedings of Stormwater and Water Quality Model User Group Meeting, January 27-28, 1983, University of Florida, Gainesville. p 272-280, 1 Fig, 3 Tab.

Descriptors: *Storm sewers, *Design criteria, *Models, *Optimization, *Hydraulic models, *Sewer systems, *Cost-benefit analysis, *Hydraulic design, Model studies, Comparison studies, Sewers, Hydrographs, Runoff, Infiltration, Design Flow.

The STORM SEWER OPTIMUM DESIGN is a computer model which provides a fast means for estimating the optimum sewer system features for the least construction costs. The model is composed of a hydrograph computation compartment and design-flow compartment which coordinate to fully utilize the final sewer system. The OPTIMUM DESIGN method uses the real rainfall in selecting design and calculates the costs of sewer components to make cost-benefit analyses of alternative routes easy and effective. The model contains features for the automatic numbering of manholes and sewer lines and for the extension of existing sewer sytems to make storm sewer design more flexible. The OPTIMUM DESIGN method can accommodate users with less extensive engineering backgrounds than usually required of users of the Rational Method for storm sewer design.
W86-00100

POINTE COUPEE PUMPING STATION SUMP AND OUTLET STRUCTURE, UPPER POINTE COUPEE LOOP AREA, LOUISIANA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8C.
W86-00101

ENERGY LOSSES AT STRAIGHT-FLOW-THROUGH SEWER JUNCTIONS,
National Water Research Inst., Vancouver (British Columbia).
J. Marsalek.
Environment Canada, Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 111, 1981. 29 p, 9 Fig, 4 Tab, 13 Ref.

Descriptors: *Energy loss, *Sewer hydraulics, *Sewer systems, *Manholes, *Flow velocity, *Flow characteristics, *Pipe flow, *Hydraulics, Energy dissipation, Mathematical studies, Channel flow, Pipes, Pipelines.

Energy losses at straight-flow-through sewer junctions with free water surface were found to be considerably less than those in fully-pressurized pipe junctions without the free water surface. Mean energy losses observed for open-channel junctions were less than those for the same junc-

tions operating under pressure. There were only small differences in energy losses between square and circular manholes. Energy losses were less in manholes with installed benching. The junction energy loss coefficient was nearly doubled for manholes with pressurized flow and nearly halved for manholes with a benching extending to the pipe crown. In sewers with closely spaced manholes, the overall system capacity may suffer marked energy losses. These may be compensated for by providing additional drops in the pipe invert. Such modifications are particularly important for surcharged sewer systems in which flow velocities and the corresponding junction energy losses may become appreciable. The energy loss coefficients presented in this report can provide data useful in the computerized calculation of pressurized flow.
W86-00103

HYDRAULICS FOR OPERATORS,
Michigan Dept. of Public Health, Lansing. Section of Water Supply.
W. E. Brown.
Water Treatment Plant Operations Series, Volume 3, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by V. W. Langworthy. 145 p.

Descriptors: *Hydraulics, *Hydrodynamics, *Flow characteristics, *Fluid mechanics, Orifices, Pipe flow, Channel flow, Flow measurement, Weirs, Manometers, Pumps, Pumping, Reviews.

This text is designed for trainees and personnel involved in water utility operations. Twelve lessons are presented on the flow of water and wastewater through pipes and channels, the use of pumps, and the effects of pressure exerted by water in a constructive or destructive fashion. Subject matter is presented in the simplest manner possible, and each lesson terminates with a list of problems and solutions for commonly encountered calculations or situations in the water utility field. The lessons presented are: hydraulic concepts, pressure, fundamentals of flow, pipe flow with friction loss, compound pipes, minor losses in fluid flow, flow in open channels, flow measurements, pump types and characteristics, and pumping. Lessons on the fundamentals of flow deal with head flow and Bernoulli's equation. Lessons on flow measurements deal with orifices, pipe flow, and Venturi meter, flow rate controls, manometers, weirs, other channel metering devices, and flow from the end of a pipe.
W86-00135

DIMENSIONS FOR SAFE AND EFFICIENT DEEP-DRAFT NAVIGATION CHANNELS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
H. O. Turner.
Technical Report HL-84-10, December 1984. Final Report. 39 p, 27 Fig, 8 Ref.

Descriptors: *Model studies, *Design criteria, *Channel improvement, *Channel morphology, *Channels, *Navigation, Models, Watercourses, Planning, Telemetry.

Existing criteria for the design of deep-draft channels were evaluated to determine if revisions could be made to channel dimensions. Free-running, remote-controlled model ships at a scale of 1:100 were used to examine deep-draft navigation channel design methods. The tanker class of ships was used in the testing program because of the wide beam and slow response to rudder commands. The model ships were equipped with a video camera and telemetry instrumentation. Performance data concerning rudder angle, shaft rpm, and heading were also recorded and plotted. The straight reach tests were conducted at a depth to draft ratio of 1.2. The channel width dimension was narrowed until an unsafe condition existed. Results of model test for both one-way and two-way traffic showed that only a slight reduction in channel widths (about 10%) could be made. Additional safety factors should be allowed; however, revisions of the design criteria should not be based on the results of this study due to model scale effects and inaccuracies in the facility.
W86-00148

WEIR JETTY PERFORMANCE: HYDRAULIC AND SEDIMENTARY CONSIDERATIONS, HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W86-00152

BARCELONA HARBOR, NEW YORK, DESIGN FOR HARBOR IMPROVEMENTS: HYDRAULIC MODEL INVESTIGATION,
Coastal Engineering Research Center, Vicksburg, MS.
For primary bibliographic entry see Field 8A.
W86-00157

COMPUTER MODELING OF HYDRODYNAMICS AND SOLUTE TRANSPORT IN CANALS AND MARINAS: LITERATURE REVIEW AND GUIDELINES FOR FUTURE DEVELOPMENT,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5B.
W86-00179

CLEVELAND HARBOR, OHIO: DESIGN FOR THE SAFE AND EFFICIENT PASSAGE OF 1,000-FT-LONG VESSELS AT THE WEST (MAIN) ENTRANCE, HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W86-00204

MEGEE CREEK PUMPING STATION SIPHON, PIKE COUNTY, ILLINOIS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Copeland.
Technical Report HL-82-23, September 1982. Final Report. 73 p, 17 Fig, 6 Tab, 6 Photos, 25 Plates, 15 Ref.

Descriptors: *Hydraulic structures, *Siphons, *Flood control, *Pumping plants, MeGee Creek Pumping Station, Hydraulic models, Model studies, Saxophone siphon, Outlets, Hydraulic jump.

A 1:4.36-scale hydraulic model of the proposed McGee Creek pumping station siphon was used to develop a design with adequate hydraulic performance. The saxophone outlet design was modified to ensure maintenance of the priming seal. Priming times and head losses were measured in the model. Modifications to decrease priming times were tested, including a reduced cross-sectional area at the crown, and air escape vents. The recommended design siphon operated satisfactorily for the entire range of expected tailwaters and discharges. (Author)
W86-00219

CHANNEL WIDTHS IN BENDS AND STRAIGHT REACHES BETWEEN BENDS FOR PUSH TOWING: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
L. J. Shows, and J. J. Franco.
Technical Report HL-82-25, October 1982. Final Report. 38 p, 9 Fig, 4 Photos, 7 Plates.

Descriptors: *Hydraulic structures, *Transportation, *Waterways, *Channel morphology, Navigable waters, Towing, Hydraulic models, Model studies, Shallow water, Ships.

This investigation was concerned with the development of parameters that could be used as a guide in the layout and design of shallow-draft waterways, particularly bends and straight reaches between bends. Results are based largely on model studies using different linear scales and some limited prototype tests. In negotiating a bend or making a turn, tows occupy a greater channel width than in straight reaches. The width of channel required depends on the deflection or drift angle which varies with the size of tow, radius of the bend or turn, length of the bend up to about 90 degrees, alignment and velocity of currents, weather conditions, direction of travel (upstream or downstream), draft of tow with respect to channel depth, alignment and location of the tow when entering the bend, and maneuverability of the tow. If the deflection angle assumed by a tow in negotiating a bend is known, the width of channel required can be computed using one of the equations from this study. Results include curves showing the deflection angle assumed by tows of various sizes in bends of different curvatures with and without currents. Also covered are bends consisting of compound curves, bends with irregular band lines, and lengths of straight reaches required between alternate bends. (Author)
W86-00225

MISSION BAY HARBOR, CALIFORNIA, DESIGN FOR WAVE AND SURGE PROTECTION AND FLOOD CONTROL: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
C. R. Curren.
Technical Report HL-83-17, June 1983. Final Report. 314 p, 12 Fig, 28 Tab, 100 Photos, 72 Plates, 23 Ref, 3 Append.

Descriptors: *Hydraulic structures, *Waves, *Shore protection, *Flood control, *Breakwaters, Tides, Hydraulic models, Model studies, Mission Bay Harbor, San Diego River, California, Harbors, Navigation, Shoals, Jetties, Surges, Water currents, Channels, Wave height.

A 1:100-scale hydraulic model of the Mission Bay Harbor, California, area was used to study proposed structures for improving navigation conditions at the harbor entrance, reducing surges inside the harbor, and eliminating potential flood hazards from a sand plug in the San Diego River flood control channel. Two alternatives were found viable for protecting the harbor from waves and surges. Both involved an offshore 1600-ft breakwater. Tests of the present configuration in the channel showed that upstream flooding occurred at 97,000 cfs, the maximum flood flow, as well as at 49,000 cfs. Several alternatives reduced flooding reducing the elevation of the sand plug by 6 ft dredging sections of the sand plug, building a wei into the middle jetty. To prevent formation of the sand plug several methods were also effective extension of the south jetty, construction of a pilo channel in the sand plug, and a diversion structure on the middle jetty.
W86-00255

EDGEWATER MARINA, CLEVELAND, OHIO DESIGN FOR WAVE PROTECTION, HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station Vicksburg, MS. Hydraulics Lab.
R. R. Bottin, and H. F. Acuff.
Technical Report Hl-83-11, July 1983. Fina Report. 79 p, 6 Fig, 6 Tab, 28 Photos, 14 Plates, 1 Ref, Append.

Descriptors: *Hydraulic structures, *Shore protection, *Harbors, *Lakes, Breakwaters, *Waves, Navigation, Storms, Marinas, Cleveland Harbor Edgewater Marina, Lake Erie, Hydraulic models, Model studies, Lake shores, Protection, Water currents, Wave height.

A 1:100-scale model was used to evaluate planne improvements at Edgewater Marina, Clevelan Harbor, Lake Erie. These improvements were 2 combinations of the following: modifications to th harbor entrance and channel, installation of ne breakwaters, modifications to the existing stru tures, and installation of rubble absorbers in th harbor. Several optimal improvement plans we chosen, and of which should reduce or elimina hazardous wave-induced currents in the bas during boating season. Optimal plans were chos

r the following scenarios: (1) new breakwater talled at the entrance and the east breakwater sed to 9.5 ft, (2) absorber installed at the en- nce and east breakwater raised to 9.5 ft, (3) sting entrance closed and raised to 9.5 ft, east eakwater raised to 9.5 ft, and new entrance rough the west breakwater, and (4) curved por- n of the Edgewater breakwater replaced with domly placed stone and east breakwater raised 15 ft.
86-00256

ESIGN FOR PREVENTION OF BEACH ERO- ON AT PRESQUE ISLE BEACHES, ERIE, NNSYLVANIA: HYDRAULIC MODEL IN- STIGATION,
my Engineer Waterways Experiment Station, cksburg, MS. Hydraulics Lab.
C. Seabergh.
chnical Report HL-83-15, June 1983. Final port. 315 p, 24 Fig, 4 Tab, 194 Plates, 10 Ref.

scriptors: *Hydraulic structures, *Beaches, reakwaters, *Lakes, *Shore protection, Sedi- nt transport, Wave action, Water currents, oins, Model studies, Hydraulic models, Erosion ntrol, lake shores, Presque Isle, Lake Erie.

ach erosion at Presque Isle on Lake Erie was died with a 1:50-scale hydraulic model. Various shore breakwater plans were tested. Satisfactory ults were obtained with 150-ft-long breakwaters h 350-ft spacing, regardless of groin presence or nformation. Tombolo development was depend- on proximity to groins, water level, wave ght and period, crown elevation of the struc- e, distance of the breakwater from the initial reline, and sediment supply. Once a tombolo attached to the breakwater, high water levels waves overtopping the breakwater were re- red to erode the tombolo beachline back from offshore breakwater. The strong longshore cur- ts seen in the baseline tests were replaced by wer eddy-type currents behing the breakwaters. arge wave situations, currents moving lakeward ween the breakwaters were diffused. Most sedi- nt was retained shoreward of the line formed by offshore breakwaters.
6-00257

NCTIONAL DESIGN OF CONTROL STRUC- RES FOR OREGON INLET, NORTH CARO- NA: HYDRAULIC MODEL INVESTIGA- ON,
ny Engineer Waterways Experiment Station, ksburg, MS. Hydraulics Lab.
W. Hollyfield, J. W. McCoy, and W. C. bergh.
chnical Report HL-83-10, June 1983. Final port. 458 p, 25 Fig, 11 Tab, 15 Photos, 365 tes, 4 Ref.

scriptors: *Hydraulic structures, *Breakwaters, annels, *Tidal effects, Manteo Bay Project, gon Inlet, North Carolina, Hydraulic models, del studies, Jetties, Inlets, Waterways, Shoals, vigation.

ntrol of shoaling and breaking waves in Oregon et in North Carolina's Outer Banks was investi- ed by model testing. The model for the Manteo Project had a 1:300 horizontal and 1:60 verti- scale. Testing included the study of jetty align- nt, length, and spacing and the effects of jetty ctures on tidal exchange and on the flow ough Bonner Bridge. Steady-state ebb and flood m surges were reproduced to study the effects he jetties on these flows. Staged jetty construc- tests helped to determine the best construction uence to limit excessive scour velocities. Mova- bed tests provided information on the effects of ies on channel alignment for both normal tides during storm surge conditions. A parallel two- y arrangement would not negatively impact the l exchange, storm surge flows, or flow through nner Bridge over the inlet. Spacings of 2500, 0, and 5000 ft were all suitable. However, the e spacings may permit bifurcation of the en- ce channel or a more curvilinear channel.
6-00269

WAVE DATA ACQUISITION AND HINDCAST FOR SAGINAW BAY, MICHIGAN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 2H.
W86-00282

BLOOMINGTON SPILLWAY NORTH BRANCH POTOMAC RIVER MARYLAND AND WEST VIRGINIA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
B. P. Fletcher.
Technical Report HL-83-9, June 1983. Final Report. 68 p, 11 Fig, 1 Tab, 8 Photos, 30 Plates.

Descriptors: *Hydraulic structures, *Spillways, *Dams, *Model studies, Hydraulic models, Bloomington Spillway, Potomac River, Gates, Dikes, Tainter gates, Eddies, Water currents, Flow pattern, Overburden, West Virginia, Maryland.

Tests to investigate hydraulic performance of the gated spillway and the intensity of return flow on the downstream side of the saddle dike were conducted using a 1:60-scale model. Flow approaching the spillway was satisfactory for all anticipated flow conditions. Eddies generated immediately upstream from the spillway had no significant effect on hydraulic performance. During controlled releases, no surging of flow at the abutments or tainter gates was observed. Model tests of the exit area were conducted with the overburden fixed and then movable. Tests conducted with the fixed overburden indicated that the maximum spillway flow of 178,000 cfs generated only an insignificant (4-ft depth at toe) amount of return flow toward the downstream toe of the saddle dike. Tests conducted with the movable overburden indicated significant displacement caused by a spillway flow of 10,000 cfs. Flows as great as 178,000 cfs caused additional displacement of overburden. The overburden did not scour upstream to the toe of the dike. Test results indicated that the safety of the saddle dike was not jeopardized by return flow with either the fixed or movable overburden simulated in the model. For any spillway flow condition, overburden material downstream from the spillway was transported through the swale and there was no tendency for a debris dam to form. (Author)
W86-00285

GRAYS LANDING SPILLWAY AND STILLING BASIN, MONONGAHELA RIVER, PENNSYLVANIA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
E. D. Rothwell, N. R. Oswalt, and S. T. Maynord.
Technical Report HL-81-13, November 1981. Final Report. 78 p, 6 Fig, 8 Tab, 32 Photos, 12 Plates.

Descriptors: *Hydraulics, *Spillways, Stilling basins, *Reservoirs, *Dams, Hydraulic models, Model studies, Grays Landing Spillway, Monongahela River, Pennsylvania, Ice, Baffles, Design criteria, Energy dissipation, Locks, Riprap.

The hydraulic performance of the deeply submerged stilling basin for the Grays Landing spillway was studied on a 1:36-scale section model. The best design was a conventional hydraulic jump type energy dissipator which would perform well for both initial construction of one lock, a 576-ft-wide spillway crest and stilling basin, and the ultimate construction of two locks, a 460-ft-wide spillway crest and stilling basin. This design allowed the baffle blocks to be located farther downstream to prevent the ice from attacking the baffles and stilling basin apron. The recommended downstream riprap protection consisted of a 72-ft length of 30-inch riprap with a maximum stone weight of 1350 pounds, followed by a 108-ft length of 18-inch riprap with a maximum stone weight of 292 pounds.
W86-00304

8C. Hydraulic Machinery

POINTE COUPEE PUMPING STATION SUMP AND OUTLET STRUCTURE, UPPER POINTE COUPEE LOOP AREA, LOUISIANA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Copeland.
Technical Report HL-83-3, March 1983. Final Report. 103 p, 20 Fig, 32 Tab, 18 photos, 8 plates.

Descriptors: *Models, *Model studies, *Pumps, *Hydraulic models, *Hydraulic equipment, *Design criteria, *Sumps, *Stilling basins, Hydraulic machinery, Performance evaluation, Pumping plants.

Physical models were used to arrive upon a design that would afford optimum hydraulic performance of the Pointe Coupee pumping station sump and outlet structure. A sump design with umbrellas on the suction bells, converging sidewalls, and horizontal vortex supressor beams gave satisfactory sump performance for pumps with low submergence. The umbrellas significantly reduced surface vortices and pressure fluctuations by spreading the flow entering the suction bell. Converging sidewalls streamlined the flow lines entering the suction bell, thus reducing the swirl and the tendency to form surface vortices. The best location for the vortex suppressor beams was just above the upstream lip of the umbrella. Beams should extend approximately 1 ft into the flow and be about 1 ft apart. A hydraulic jump type stilling basin with baffles and divider walls was also developed. Riprap sizes were determined for the outlet channel downstream from the stilling basin. With these modifications, satisfactory sump performance was obtained even for the adverse approach conditions that occur with single pump operations.
W86-00101

MEGEE CREEK PUMPING STATION SIPHON, PIKE COUNTY, ILLINOIS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-00219

FLATIRON AGC INTERIM CONTROLLER-VOLUME IV,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
W. B. Gish, T. R. Whittemore, C. A. Lennon, and S. C. Stitt.
REC-ERC-84-6, March 1984. 167 p, 165 Fig, 2 Ref.

Descriptors: *Hydraulic machinery, *Electrical equipment, *Computers, *Control systems, *Automation, Flatiron Automatic Generation Controller, Controllers, Laramie River Power Station, Mt. Elbert Powerplant.

The Flatiron Interim Automatic Generation Controller has been placed in service for the Lower Missouri Western Area Power Administration Control Area. This controller controls the energy generation and transfers in northern Colorado, Wyoming, western Nebraska, western South Dakota, and southern Montana. The four-volume series details the design, construction, maintenance and operation of the master station and the remote stations. This volume contains all the hardware and software drawings for the first three volumes in the series, which document the master station system at the Dispatch Center, the Laramie River Power Station RTU, and at Mt. Elbert Powerplant RTU.
W86-00223

BARKLEY DAM SPILLWAY TAINTER GATE AND EMERGENCY BULKHEADS, CUMBERLAND RIVER, KENTUCKY: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station,

Vicksburg, MS. Hydraulics Lab.
J. E. Hite, and G. A. Pickering.
Technical Report HL-83-12, August 1983. Final Report. 77 p, 9 Fig, 8 Tab, 12 Photos, 29 Plates.

Descriptors: *Hydraulic structures, *Dams, *Gates, *Spillways, Tainter gates, Spillway gates, Barkley Dam, Cumberland River, Kentucky, Locks, Navigation, Reservoirs, Model studies, Flow pattern, Stilling basins, Piers, Bulkhead gates.

Tests were conducted on 1:15- and 1:50-scale models to determine the cause of and to make modifications for eliminating tainter gate bouncing experienced under certain flow conditions at Barkley Dam. The 1:15-scale model determined the flow conditions that caused the bouncing, and the hydraulic loads and load variations acting on the gate during this occurrence. Hoist load fluctuations in excess of 140 kips were measured. The bottom of the tainter gate was modified to various configurations in an effort to alter the flow patterns causing the bouncing, but these modifications were relatively ineffective in reducing the hoist loads. A 1:50-scale model was incorporated into the study to determine the effect of the downstream spillway piers and the stilling basin on the flow conditions. Test results indicated that increasing the length of the spillway piers by 20 ft downstream reduced the surging of flow assiociated with the bouncing. A minimum top elevation of these extended piers was determined to be 345.0. The hoist loads were then measured with the piers placed in the 1:15-scale model. The maximum hoist load fluctuation was reduced by over 100 kips from 140 kips with the original design to 40 kips with the piers extended. The 1:15-scale model was also used to determine the hydraulic loads that occur as the emergency bulkheads are lowered under flowing water conditions. The bulkhead tests revealed that the loads on the hoist due to hydraulic forces were not extreme for heads on the gate still of 21, 29, and 34 ft as long as the bulkhead was lowered at the prototype hoisting speed of 4 to 6 ft/min. Unstable loads were encountered at heads of 29 and 34 ft on the gate sill when the bulkhead was held at stationary position above the crest with high tailwater conditions. (Author)
W86-00284

8D. Soil Mechanics

PROGRAM CRITERIA SPECIFICATIONS DOCUMENT: COMPUTER PROGRAM TWDA FOR DESIGN AND ANALYSIS OF INVERTED-T RETAINING WALLS AND FLOODWALLS,
Army Engineer Div. Lower Mississippi Valley, Vicksburg, MS.
For primary bibliographic entry see Field 8A.
W86-00193

CHANNEL CONTROL STRUCTURES FOR SOURIS RIVER, MINOT, NORTH DAKOTA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W86-00209

LIST OF SOILS, SOIL-STRUCTURE INTERACTION AND OTHER RELATED COMPUTER PROGRAMS AVAILABLE FOR LMVD ENGINEERS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Automatic Data Processing Center.
N. Radhakrishnana, and P. K. Senter.
Technical Report K-81-1, May 1981. Final Report. 146 p.

Descriptors: *Soil mechanics, *Computer programs, *Hydraulic structures, *Earthworks, T-walls, Slope stability, Retaining walls, Piles, Seepage, Stress, Structural settlement, Piezometers, Measuring instruments, Surveying instruments, Data processing, Plotting, Finite difference methods, Earthquakes, Mississippi River Valley.

This report presents a list of soils, soil-structure interaction, and other related computer programs available for engineers of the Lower Mississippi Valley Division. Programs for use in the following subject areas are listed: T-walls; slope stability; piles, sheet piles, and cells; seepage; stress computation, settlement, and consolidation; piezometer data; instrumentation and laboratory data; plotting programs; finite element and finite difference methods; earthquakes and dynamics; and others. Also included are abstracts of some of the listed programs. (Author)
W86-00262

WAVE STABILITY STUDY OF RIPRAP-FILLED CELLS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W86-00283

8E. Rock Mechanics and Geology

SAND RESOURCES AND GEOLOGICAL CHARACTER OF LONG ISLAND SOUND,
Coastal Engineering Research Center, Fort Belvoir, VA.
S. J. Williams.
Technical Paper No. 81-3, May 1981. 65 p, 27 Fig, 5 Tab, 54 Ref, 2 Append. Project No. D31665.

Descriptors: *Shoals, *Beaches, *Shore protection, *Sediments, Marine sediments, Sand, Gravel, Long Island Sound, Connecticut, Dredging, Bottom sediments, Geology, Marine geology, Continental shelf, Erosion.

Seismic profiles and vibratory cores were used to determine the geologic character of Long Island Sound. Fourteen isolated shoal features were identified as potential sources of beach fill sand and construction aggregate. About 189 million cu m of sand and gravel was estimated to be in water depths not exceeding 20 meters. Fifteen Connecticut beaches needing beach nourishment now and in the future were identified. Many parks and beaches on Long Island's north shore also may benefit from beach fill.
W86-00205

8F. Concrete

ENGINEERING CONDITION SURVEY OF CONCRETE IN SERVICE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
R. L. Stowe, and H. T. Thornton.
Technical Report REMR-CS-1, September 1984. Final Report. 109 p, 33 Fig, 69 Ref, 1 Append.

Descriptors: *Concrete technology, *Surveys, *Concrete testing, Evaluation, Structural engineering, Materials testing, Safety, Standards, Concrete construction, Rehabilitation.

Civil works structures must be continually evaluated for structural safety, stability, and operational adequacy. The overall objective of the investigation documented in this report is to develop information essential to the continued safety of concrete used in civil works structures such as flood control and multipurpose dams, navigation locks and dams, powerhouses and appurtenant structures, floodwalls, pumping stations, and similar structures. Specific objectives include (a) the development and evaluation of materials and techniques for repair and rehabilitation of civil works structures, (b) the development of engineering guidance to evaluate and monitor safety of structures, and (c) the development of design and construction methods for rehabilitating older structures to comply with current structural design criteria. A condition survey of a civil works structure includes a comprehensive review of the design of the structure, construction techniques and materials, and operational maintenance history. Information is obtained from available engineering data on the structure as well as on-site investigations. Data are analyzed and an evaluation report is written which includes conclusions and/or repair recommendations. This report summarizes pertinent inspection procedures and methods of evaluation used by the Corps of Engineers in evaluating concrete civil works structures. Methods of evaluation include experience gained at the Waterways Experiment Station. Techniques are presented which have a potential for ascertaining the extent and cause of inadequacies in concrete structures. (Author)
W86-00161

8G. Materials

SHORE STABILIZATION WITH SALT MARSH VEGETATION,
Coastal Engineering Research Center, Fort Belvoir, VA.
P. L. Knutson, and W. W. Woodhouse.
Special Report No. 9, January 1983. 95 p, 38 Fig, 4 Tab, 94 Ref. Project No. D31234.

Descriptors: *Erosion control, *Estuaries, *Shore protection, *Marshes, *Vegetation, Fertilizers, Salt marshes, Wetland, Waves, Soil types, Sediments, Salinity, Particle size, Tidal marshes, Wind waves, Cordgrass, Spartina, Sedges, Rushes, Reeds, Mangrove, Environmental effects, Hairgrass.

Comprehensive guidelines are given on the use of marsh plants to control shore erosion from wind waves and tidal currents. Background information includes the role of marsh plants in erosion control, description of the natural coastal marshes by region, and the concept of encouraging marsh establishment to control shore erosion. Planting success depends on several factors. Soil type (cohesive or sandy) often dictates the choice of planting and fertilizer requirements. Some plants tolerate salinity up to the strength of sea water. Most marsh plants are adapted to anaerobic conditions. Exposure to direct sunlight must be assured by clearing woody vegetation 3-5 meters landward. The minimum planting width is about 6 meters. Sediment is beneficial to plantings. An evaluation form for evaluating a site for potential planting success uses shore characteristics (average and longest fetch, shoreline geometry, and sediment grain size). Smooth cordgrass (Spartina alterniflora) is suggested for the Atlantic and Gulf coasts; Pacific cordgrass (Spartina foliosa) for the southern Pacific coast; and Lyngbye's sedge (Carex lyngbyei) and tufted hairgrass (Deschampsia aespitosa) for the northern Pacific coast. Plant materials, available as sprigs, pot-grown seedlings, and plugs, can be planted by hand, power-driven auger, or machine. Fertilizers and application rates are given. Detailed planting specifications are described for a variety of plant species. Cost comparisons of erosion control methods and the potential benefits and disadvantages are summarized.
W86-00189

MODIFICATION OF BELL CANYON TEST (BCT) 1-FF GROUT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
A. D. Buck, J. E. Rhoderick, J. P. Burkes, K. Mather, and R. E. Reinhold.
Miscellaneous Paper SL-83-18, Report No. SAND 83-7097, September 1983. Final Report. 53 p, 24 Fig, 7 Tab, 6 Ref, 2 Append.

Descriptors: *Water quality control, *Grouting, *Water pollution prevention, *Radioactive waste disposal, Waste disposal, Cements, Bell Canyon, Boreholes, Fly ash, Silica fume, Physical properties, Chemical properties.

Bell Canyon Test (BCT) 1-FF grout was developed as a candidate material for use in repository sealing applications and was actually used in two field tests in New Mexico. This grout and modifications of it were made in the laboratory and tested or examined for workability, compressive strength, restrained expansion, permeability, phase composition, and microstructure. Most of these were done to an age of one year. Compressive

ngth and expansion data were determined ond this age (960 days). Modifications included of three other cements, two other fly ashes, a a fume, different water contents, and different unts of expansive additive (plaster). Each ent and mineral admixture was characterized conventional chemical and physical tests as well y X-ray diffraction examination. In general, the lts indicated that the modifications to the basic T-1-FF grout produced other grouts that were ood as it. An exception to this was the grout ture (M-8-C) made with shrinkage compensat- expansive cement; it had an excessive flow time 20 sec). Another grout mixture (M-9-C) also excessive flowtime and lower strength. It was ght that these problems could be solved with e modification to these two mixtures. (Author) 5-00248

CVENTATIVE MEASURES TO LIMIT ESS CORROSION CRACKING IN PRES- SSED CONCRETE,
y Engineer Waterways Experiment Station, sburg, MS. Structures Lab.
. O'Neil.
ellaneous Paper SL-83-14, September 1983. l Report. 15 p, 4 Fig, 8 Ref.

criptors: *Hydraulic structure, *Corrosion rol, *Construction materials, *Concrete, el, Coatings, Wires, Polymers, Stress, Cement, ls, Grouting, Aggregates.

entive measures to minimize stress corrosion king of prestressed steel are reviewed. Al- gh the mechanisms causing this type of corro- are little understood, several actions are help- ful. Steel properties may be modified to reduce the tendency to corrode. Techniques to improve stress corrosion cracking are proper stress relieving of cold-drawn wire, new methods of quenching and tempering, decarbonizing the surface of the steel, shot peening, and lower final stress levels. Any method that can exclude corrosive gases and liquids also minimizes stress corrosion cracking. Factors in this category are a dense, low-permeability concrete (proper water-cement ratio), good concrete workability, coarse aggregate material, proper vibration in compacting concrete, and longer cure time for concrete. Grouted prestressing systems can be designed with a suitable conduit and grout composition and application. Other methods of protecting steel wires are galvanization, plastic coatings, and polymer impregnated in the pore structure of the concrete.
W86-00249

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

IMPACT OF WATER LEVEL CHANGES ON WOODY RIPARIAN AND WETLAND COMMUNITIES; VOLUME X: INDEX AND ADDENDUM TO VOLUMES I-VIII,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 2I.
W86-00254

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING, 1978-1979,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
B. C. Armstrong.
EPS 3-WP-81-4, July 1981. 100 p.

Descriptors: *Bibliographies, *Wastewater treatment, *Water treatment, *Cold regions, *Arctic, *Environmental engineering, Polar regions, Ice, Dams, Construction, Industrial wastes, Water pollution.

An annotated bibliography on environmental engineering in northern regions is presented with key words and alphabetical subject index. This biennial edition covers the literature from 1978 and 1979. Among the many subjects are wastewater collection and treatment, construction, dams, water treatment and distribution, environmental impact studies, freeze protection, ice growth, industrial wastes, soils, underground utilities, water pollution, and water supply.
W86-00289

10F. Preparation Of Reviews

MICROBIOLOGICAL WATER QUALITY OF IMPOUNDMENTS: A LITERATURE REVIEW,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
For primary bibliographic entry see Field 5A.
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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04 WATER QUANTITY MANAGEMENT AND CONTROL

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05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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rt N2/1982, January 1982. 60 p.

riptors: *Meteorologic data collections, *Cli- data, *Precipitation, *Temperature, *Evapo-n, Standard deviation, Natal, South Africa, velocity, Rainfall, Elevation, Solar radiation, mperature.

s show the climatic conditions in Natal, Africa. Seven climatic elements for about 60 ns are included: maximum temperature, mini- temperature, average temperature, average ll, average evaporation, average wind veloci- d average sunshine. The importance of stand- eviation is emphasized.
00321

URN PERIOD ANALYSIS WITH SLIDING YNOMIALS,
hern Piedmont Conservation Research r, Watkinsville, GA.
. Snyder, and A. W. Thomas.
nted at the 1983 Winter Meeting of the rican Society of Agricultural Engineers, No. 83-4533, December 13-16, 1983, Chica- . 7 Fig, 3 Tab, 10 Ref.

riptors: *Sliding polynomials, *Graphical ods, *Probability distributions, *Mathematical s, *Statistical methods, *Mathematical ls, Comparison studies, *Return flow, ls, Mathematical equations, Computer ls, Statistical models, Statistical analysis, l studies, Prediction, *Flood forecasting, nical analysis.

thod of return-period analysis is presented does not require assumption of a probability on or of plotting positions. Piece-wise sliding omials are used to smooth historical samples ast squares. Imposition of a boundary control ces a restrained fitting which suppresses sample-to-sample variability for extreme . Variability of predictions for the 1-in-100 is only one-fifth the variability using the ical method. The method can be used to te uncertainty of prediction for any chosen f risk. (Author's abstract)
00374

URN PERIOD ANALYSIS OF MINIMUM NTS USING SLIDING POLYNOMIALS,
ern Piedmont Conservation Research r, Watkinsville, GA.
Thomas, and W. M. Snyder.
nted at the 1983 Winter Meeting of the ican Society of Agricultural Engineers, No. 83-4534, December 13-16, 1983, Chica- . 15 p. 7 Fig, 9 Ref.

iptors: *Model studies, *Simulation analysis, hastic process, *Sliding polynomials, *Mathe- l studies, *Mathematical models, *Probabili- ribution, Models, Probabilistic process, Plan- Temperature, Rainfall, Statistical methods, nflow, *Return period.

n-free method for determining return periods nimum values of stochastic events has been oped. Such minima represent expectancies of availability of natural resources and their es can aid planners and managers of agricul- oduction systems. The method for return- analysis of minimum events, like that for um events, used form-free sliding polynomi- smoothing operators, thus reducing the bias ced by assuming some particular probability on as a smoothing operator. Studies of mini- ainfall, streamflow and temperatures showed lity in shaping the smoothing curves while ining faithful adherence to the sample data. Simulations were used to compute and expected range of future events associated with any level of risk selected by the user. Simulations of long-period and short-period possible future minima for different return periods showed that the uncertainties faced by planners and managers are highly conditioned by unique features of particular data sets and by the length of the return period over which costs and benefits might be averaged.
W86-00375

TESTING THE CLIMATIC REPRESENTATIVENESS OF SHORT-PERIOD RECORDS THROUGH SIMULATION,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. Thomas, and W. M. Snyder.
To be presented at: the 1984 Winter Meeting of the American Society of Agricultural Engineers, Paper No. 84-2501, December 11-14, 1984, New Orleans, LA., 16 p. 7 Fig, 3 Tab, 6 Ref.

Descriptors: *Mathematical models, *Model studies, *Rainfall, *Stochastic process, *Sliding polynomials, *Probabilistic process, *Statistical models, *Climatology, Models, Mathematical studies, Planning, Probability distribution, Statistical methods, Statistical analysis, Simulation analysis.

A form-free method was devised and tested for evaluating the climatic representativeness of short-period records. The method is similar to recently developed stochastic analyses of maximum and minimum events in that sample probabilities are least-squares derivation of arcs of the four-point sliding polynomials. Both large and small events were analyzed as well as averages or totals. In addition, a procedure was devised to handle the occurrences of numerous days with no rainfall with an adaptation of the virtual and real approach based on smoothing with sliding polynomials. The stochastic characteristics of long term rainfall record established a probabilistic scale against which to test events during short-period research. This probability scale determined a standard from which judgemental assessment to representativeness can be made. Planners must consider the representativeness of data in order to assess agricultural practices and programs.
W86-00376

SOIL-PLANT-WATER MODEL WITH A CASE STUDY IN A FORESTED CATCHMENT,
Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Ressources Renouvelables.
For primary bibliographic entry see Field 2I.
W86-00595

2B. Precipitation

COMBINED HYDROMETEOR DISTRIBUTIONS FROM THREE PMS PROBES,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W86-00308

TESTING THE CLIMATIC REPRESENTATIVENESS OF SHORT-PERIOD RECORDS THROUGH SIMULATION,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 2A.
W86-00376

GROSSVERSUCH IV: 'EXTENDED AREA' EFFECTS ON RAINFALL,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
For primary bibliographic entry see Field 3B.
W86-00424

OBSERVATION ON MICROPHYSICAL PROCESSES IN THE STRATIFORM PRECIPITATIONS INCLUDING MELTING LAYERS AT MT. FUJI,
Nagoya Univ. (Japan). Water Research Inst.
T. Yokoyama, H. Tanaka, K. Akaeda, T. Ohtani, and N. Yoshizawa.
Journal of the Meteorological Society of Japan, Vol. 63, No. 1, p 100-111, February, 1985. 9 Fig, 1 Tab, 18 Ref.

Descriptors: *Mt. Fuji, *Japan, *Precipitation, *Snow, *Rain, Stratiform, Micrometeorology.

In order to investigate microphysical processes in stratiform precipitations including melting layers, size distributions of the precipitation particles were measured by filter paper methods at three observational stations with different altitude on Mt. Fuji, Japan. Where snowflakes form, above or at the upper edge of the melting layer, small sized particles smaller than 0.1 cm in diameter were predominant in number and volume. Where snowflakes melt and refreeze, forming sleet, and in the melting layer, large sized particles larger than 0.2 cm increase in number and predominate in volume. Small sized particles decrease. Where raindrops form, below the melting layer, medium sized particles between 0.1 and 0.2 cm predominate in volume. The vertical change of the size distribution of raindrops was insignificant far below the melting layer. (Baker-IVI)
W86-00425

EXPERIMENTS ON AEROSOL SCAVENGING BY NATURAL SNOW CRYSTALS, PART I: COLLECTION EFFICIENCY OF UNCHARGED SNOW CRYSTALS FOR MICRON AND SUBMICRON PARTICLES,
Hokkaido Univ., Sapporo (Japan). Div. of Environmental Structure.
M. Murakami, K. Kikuchi, and C. Magono.
Journal of the Meteorological Society of Japan, Vol. 63, No. 1, p 119-129, February, 1985. 11 Fig, 17 Ref.

Descriptors: *Aerosols, *Snow, *Precipitation, Micrometeorology, Clouds, Crystals, Collection efficiency.

In order to verify the collection efficiencies which were observed in earlier studies and to investigate some effects on the collection efficiency, experiments on the collection of aerosol particles (0.1 micro-m $<$ dp $<$ 6 micro-m) by uncharged natural snow crystals were carried out in an aerosol chamber. The collection efficiency of the uncharged snow crystals decreased with the decreasing aerosol size from 6 micro-m to 0.2 micro-m in diameter. The collect efficiency attained the minimum value at around 0.2 micro-m, and increased with the decreasing aerosol size from 0.2 micro-m to 0.1 micro-m. As for the aerosol particles of 0.2 micro-m to 6 micro-m in diameter, it was deduced that the interception was the main scavenging mechanism. The difference between the collection efficiencies of the rimed and unrimed snow crystals was small in the present experiments. This means that the aerodynamic effects were small. The difference of one order of magnitude between the collection efficiencies of the rimed and unrimed snow crystals, obtained in earlier studies, was attributed to the in cloud scavenging effect. The collection efficiency obtained in the present experiments was almost coincident with that of the unrimed snow crystals obtained from previous field observations. The observational values of particle averaged collection efficiency previously obtained were verified by the collection efficiency, which was given as a function of particle size, obtained in the present studies. (Baker-IVI)
W86-00426

BUDGET OF NITROGEN DISSOLVED IN RAINFALL DURING ITS PASSING THROUGH THE CROWN CANOPY IN FOREST ECOSYSTEMS,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
A. Stachurski, and J. R. Zimka.
Ekologia Polska, Vol. 32, No. 2, p 191-218, 1984. 11 Fig, 7 Tab, 17 Ref.

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Descriptors: *Throughfall, *Canopy, *Nitrogen, *Rainfall, *Forests, Fauna, Leaching, Aerosols, Ecosystems, Nutrients, Poland.

The effects of hydrologic and biotic factors on the budget of nitrogen in throughfall were investigated. A new type of rain trap with a double filter system was set up in open spaces and beneath the canopy. During the growing season nine forest ecosystems representing five physiosociological units were analyzed in the Kampinos National Park and in Masurian forests in Poland. The input of nitrogen in water solutions from the atmosphere ranged from 3.8 kg/ha/growing season to as much as 21.8 kg/ha/growing season. The rate of nitrogen input was also variable. The budget of dissolved nitrogen in the forest ecosystems was positive (Kampinos) or strongly negative (Masuria), but no consistent differences could be found related to a particular species structure of the stands. Using the multiple regression method, the effect was analyzed of four factors on the nitrogen budget discussed: amount of rainfall intercepted by the canopy, amount of water in the throughfall phytophage activity measured by biomass, and the quantity of nitrogen input with water solutions from the atmosphere. Phytophage activity caused an enrichment of the throughfall with nitrogen, while dissolved nitrogen input from the atmosphere was absorbed by the canopy layer. Nearly 80% of the nitrogen input from the atmosphere was absorbed by the canopy. The passing of nitrogen in water solutions through the canopy is not static in nature, nor is it controlled by hydrologic factors. It is a fully dynamic process controlled by biotic factors, and its final result is determined by the quantitative predominance of either factor, the effect of which is opposite to that of the other: nitrogen absorption by the canopy, and phytophage activity. (Baker-IVI)
W86-00437

SIMULATION OF CORRELATED RAINFALL AMOUNT AND DURATION DATA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
K. B. Rojiani, K. A. Tarbell, V. O. Shanholtz, and F. E. Woeste.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 129-132, January/February, 1985. 5 Fig, 2 Tab, 6 Ref. OSM grant G1115514.

Descriptors: *Rainfall, *Simulation, Distribution, Duration, Least squares method.

Rainfall amount and storm duration are two important variables in the modeling and simulation of erosion loss and sediment yield. Because rainfall amount and storm duration are often correlated, a procedure for simulating this correlation is desirable. A technique is presented for generating compatible sets of rainfall amount and storm duration values. The method is based on regression analysis and requires a knowledge of the distribution of one of the individual variables and the correlation between the two variables, but not the joint probability distribution. Random values generated from the distribution of storm duration are used to predict the associated random values of the rainfall amount. Using a 28 year data base from Blacksburg, Virginia, distributions for rainfall amount and storm duration were obtained. Using the model, compatible values of rainfall amount and storm duration were generated using the regression model. A comparison of distribution form and distribution parameters for the original and simulated data indicated that the simulated data mimicked the original data. The technique provides a useful and practical method for generating correlated rainfall data. (Baker-IVI)
W86-00492

ESTIMATING SOIL DETACHMENT CAUSED BY RAINDROP IMPACT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. E. Gilley, and S. C. Finkner.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 140-146, January/February, 1985. 2 Fig, 4 Tab, 22 Ref.

Descriptors: *Rain, *Impact, *Velocity, *Soil detachment, Kinetic energy, Mathematical equations, Soil erosion.

This study was an attempt to evaluate, using existing data, the performance of several soil detachment relations; identify a detachment equation for use with raindrops impacting at terminal velocity and determine the rainfall detachment factor as a function of rainfall itensity for natural rainfall conditions. The rainfall factors which were examined included: kinetic energy times unit of drop area, kinetic energy times unit of drop circumference, kinetic energy, kinetic energy per unit of drop circumference, kinetic energy per unit of drop area, momemtum times unit of drop area, momentum times unit of drop circumference, momentum, momentum per unit of drop circumference and momentum per unit of drop area. Dimensionless equations incorporating each of these parameters were derived. For the selected rainfall factors, the only difference between the dimensionless equations was found to exist in the exponent values to which the relative raindrop diameter and velocity variables were raised. Use of kinetic energy times unit of drop circumference for determining soil detachment for individual soils was also examined. The reliability of estimates obtained using this factor varied significantly between soil materials. For the case of raindrops falling at terminal velocity, impact velocity was written as a function of raindrop diameter and, therefore, eliminated in the detachment equation. From information available in the literature on the drop size distribution of natural rainfall at varying rainfall intersities, an equation relating soil detachment to rainfall intensity was obtained. (Baker-IVI)
W86-00494

DROP SIZE DISTRIBUTION MEASUREMENT PROBLEMS USING A LASER UNIT,
South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 7B.
W86-00502

2D. Evaporation and Transpiration

TABLES FOR ESTIMATING DAILY EVAPORATION RATES OVER CROPS USING TEMPERATURE, ELEVATIONAL AND LATITUDINAL DATA ONLY,
Cedara Research Inst., Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 2I.
W86-00313

TRANSPIRATION EFFICIENCY IN RELATION TO NUTRIENT STATUS,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
G. K. Walker, and J. E. Richards.
Agronomy Journal, Vol. 77, No. 2, p 263-269, March-April, 1984. 4 Fig, 3 Tab, 21 Ref.

Descriptors: *Alfalfa, *Corn, *Transpiration, *Nutrients, Potassium, Biomass, Water use, Evapotranspiration, Fertilizers.

Many experiments have shown a linear relationship between plant biomass and water use. Despite this, it is thought that general nutrient deficiency lowers transpiration efficiency. Since little attention has been given to the effects of specific nutrients, a study was designed to examine the effects of a single nutrient, K, on the transpiration efficiency of alfalfa (Medicago sativa L.). In addition, maize (Zea mays L.) biomass and water-use data obtained in 1911 by Montgomery and Kiesselbach, at a range of nutrient levels, were reanalyzed to further assess nutrient effects on transpiration efficiency. In a greenhouse study, 'Banner' alfalfa was grown, in pots, in a range of soils varying widely in K status but otherwise adequately fertilized. A sand mulch was used to minimize evaporation from the pots. Evapotranspiration (determined by weighing) and biomass data were collected over seven regrowth cycles. At every harvest there was a wide range in tissue K status, but only at harvest four did transpiration efficiency appear reduced stricted K supply. Biomass and evapotrans remained well correlated and linearly rela every harvest, despite the increasing occurr severe K deficiency as the experiment pro Transpiration efficiency did fall substantia the last two harvests, possibly in response lower (winter) light regime under whic harvests were made. Although not applic specific nutrient, Montgomery and Kiesse maize data yield similar results, and do not the nutrient deficiency leads to lower trans efficiency. (Author's abstract)
W86-00464

RELATIONSHIPS BETWEEN CROP W STRESS INDEX AND ALFALFA YIELI EVAPOTRANSPIRATION,
New Mexico Agricultural Experiment Stati Cruces.
For primary bibliographic entry see Field 2
W86-00468

TIME SERIES ANALYSIS OF DAILY S RADIATION AND AIR TEMPERA MEASUREMENTS FOR USE IN COMP POTENTIAL EVAPOTRANSPIRATION,
California Univ., Riverside. Dept. of Soil and Agricultural Engineering.
N. Persaud, and A. C. Chang.
Transactions of the American Society of A tural Engineers, Vol. 28, No. 2, p 462-470, April, 1985. 7 Fig, 7 Tab, 10 Ref.

Descriptors: *Time series analysis, *Air t ture, *Evapotranspiration, *Solar radiation oration, Transpiration, Temperature effects.

Time series analysis techniques were used t the bivariate relationships between daily m minimum, or average air temperatures a radiation. The data utilized in the analysis ed of 1096 daily observations of the four v taken near Arvin in the San Joaquin Valle fornia for the years 1959-1961. The annu and the semi-annual cycle contributed the the variance of the temperature series. S analysis in conjunction with Box-Jenkins function techniques proved useful to estim daily solar radiation with daily temperatur urements as the input data. The potential transpiration (PET) values computed from mated solar radiation data agreed well wi obtained from computation using measure solar radiation. (Baker-IVI)
W86-00469

EFFECT OF POTENTIAL EVAPOTRAN TION ESTIMATES ON CROP MODEL LATIONS,
Agricultural Research Service, Temple, TX
W. A. Dugas, and C. G. Ainsworth.
Transactions of the American Society of A tural Engineers, Vol. 28, No. 2, p 471-475, April, 1985. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Evapotranspiration, *Math equations, *Model studies, Crop yield, Corn, Sorghum, Penman equations, Es equations, Seasonal variation, Simulation.

Crop growth simulation models integrate fects of meteorological, soil, and managem ables to simulate plant growth and devel Penman and Priestley-Taylor (PT) equat estimating potential evapotranspiration were used in sorghum, wheat, and co models. All models had been developed u PT equation. Substitution of the Penman significantly reduced simulated yields and other water-related model outputs, but h effect upon phenology. Effects were g greatest at locations where advection is During the growing season at some locati vective energy may significantly affect PE and one would assume that a water balan the Penman equation for estimating PET w more accurate. The effects were a direct changing PET and, thus, soil water stat

in status altered model processes such as
l photosynthetic, root growth, grain filling,
f growth rates. These differences were
late in the season. Other model outputs
y have been affected. Using a modification
PT PET equation, such as changing the
alue or adjusting for advective effects as a
of other meteorological elements, likely
oroduce similar kinds of results. Users of
therefore, need to be aware of the effects
g the PET equation can have on model
(Baker-IVI)
470

PIRATION RATE AND WATER USE
ENCY OF SOYBEAN LEAVES ADAPT-
DIFFERENT CO2 ENVIRONMENTS,
Univ., Gainesville. Dept. of Agronomy.
, J. W. Mishoe, J. W. Jones, and L. H.
.
ience, Vol. 25, No. 3, p 477-482, May/
85. 5 Fig, 3 Ta, 19 Ref.

ors: *Carbon dioxide, *Leaves, *Transpi-
Water use efficiency, Water loss, Water
s, Wind, Soybeans, Leaf temperature,
nthesis, Wind.

cts of carbon dioxide on leaf transpiration,
stance, leaf temperature, and water use
y (WUE) in soybean plants adapted to
CO2 environments were investigated.
the podfill period, the transpiration rate
soybean leaflets measured in leaf cuvettes
nts grown at 660 and at 330 micromol
l were not significantly different. Leaf
e and leaf temperature were higher in
dapted to high CO2 than those adapted to
CO2 levels. The similarity in leaf TR was
the result of partial compensation due to
in vapor pressure gradient (VPG) that
effects resulting from increases in leaf
e caused by high CO2. The two-fold in-
WUE of leaflets adapted to 660 micromol
l was mainly the result of a nearly two-
rease in photosynthetic rates on leaflets
high CO2 and the similarity of transpira-
between both CO2 treatments. Photosyn-
tes accounted for 94% of the relative
of WUE from 330 to 660 micromol CO2/
CO2 concentration at which WUE is half
n was not significantly different among
dapted to either the 330 or 660 micromol/
2 treatment. Leaflets adapted to high CO2
d higher asymptotic WUE due to a higher
of CO2 uptake rates and similar TR. Leaf
ure values were about 2 to 3 degrees C
t CO2 concentrations of 990 than at 90
l/mol in these controlled environment
, indicating a more important role of wind
r dissipation of leaf sensible heat in high
ironments. (Baker-IVI)
83

NSES OF C4 GRASSES TO ATMOS-
CO2 ENRICHMENT. II. EFFECT OF
STRESS,
iv., Durham, NC. Dept. of Botany.
ary bibliographic entry see Field 2I.
84

USE EFFICIENCY OF CASSAVA. III.
NCE OF AIR HUMIDITY AND
STRESS ON GAS EXCHANGE OF
ROWN CASSAVA,
nternacional de Agricultura Tropical, Cali
ia).
k, M. C. M. Porto, and M. A. El-
y.
ence, Vol. 25, No. 2, p 265-272, March/
85. 7 Fig, 5 Tab, 22 Ref.

ors: *Water use efficiency, *Humidity,
tress, *Gas exchange, *Cassava, Carbon
Vapor pressure, Leaves, Water potential,
practices, Conductance, Photosynthesis.

presented on the response of field grown
o changes in air humidity with and with-
water stress. There was a remarkable de-

crease in the leaf photosynthetic rate with decreasing air humidity in both well watered and unirrigated plants. A significant correlation was noted between leaf photosynthetic rate and vapor pressure differences (VPD) and leaf conductance. No correlation was noted with leaf water potential at midday and early afternoon. The midday leaf water potential of the plants without irrigation was slightly higher than that of the well watered plants. Photosynthetic rate of the plants without irrigation was always lower than the well watered ones. Transpiration initially increased with increased leaf to air VPD and then sharply declined with further increases in VPD. Leaf water use efficiency (WUE) decreased in curvilinear pattern with VPD. Dry root yield and total biomass production of cassava was increased by increasing the relative humidity in the crop canopy by artificial misting. There was a 91, 15, and 27% increase in dry root, top and total dry matter, respectively, after 40 days of misting as compared with controls. These differences in biomass production were associated with enhanced photosynthetic rate per unit leaf area of the misted plants. The leaf photosynthetic rate of cassava decreased with leaf age. Photosynthetic saturation irradiance was around 1500 and 800 micromol/sq m/sec for young and old leaves, respectively. (Baker-IVI)
W86-00485

DESIGN AND INSTALLATION OF LARGE WEIGHING LYSIMETERS,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
T. A. Howell, R. L. McCormick, and C. J. Phene.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 106-117, January/February, 1985. 8 Fig, 17 Ref.

Descriptors: *Design criteria, *Lysimeters, *Measuring instruments, Evapotranspiration, Estimating, Water stress, Crop growth.

The design, construction, installation, and calibration of two large weighing lysimeters are described. The lysimeters were designed to allow hourly evapotranspiration measurement, precise daily evapotranspiration measurements, evapotranspiration measurements under water stress conditions requiring a deep root zone, to permit remote data acquisition and control, and to facilitate construction and installation in a location remote from the main research office. The intended purpose of the lysimeters was to calibrate and improve combination equation potential evapotranspiration estimates, measure crop water use for several row crops, and to allow selected micrometeorological research investigations. The lysimeters were constructed in modular sections to facilitate the transport to the installation site and to minimize the use of cranes during the installation. They consisted of 5 main components: inner tank, outer tank bottom, outer tank top, access tunnel, and scale. The lysimeters were installed in a 3.6 ha field. One lysimeter was installed into a field normally used for row crop research, and the other lysimeter was installed into a grass weather station field. The resulting short term sensitivity of the lysimeter has been determined to be about 0.02 mm of evaporation (equivalent mass). The scale consists of a commercial flexure-lever action balance with a load cell final output. No counterbalance was used. The lysimeter scale appears to have excellent stability during windy conditions. (Baker-IVI)
W86-00489

AUTOMATION OF A CLASS A EVAPORATION PAN,
Agricultural Research Service, Mississippi State, MS. Crop Simulation Research Unit.
J. M. McKinion, and A. Trent.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 169-171, January/February, 1985. 5 Fig, 8 Ref.

Descriptors: *Evaporation pans, *Automation, Evaporation, Data acquisition, Stilling wells, Measuring instruments.

A pressure transducer and a stilling well were fitted to a National Weather Service Class A evaporation pan, and the system was tested for suitability for automatic acquisition of data. A ceramic differential pressure transducer (Kavlico Corp.) and a Setra Model 239E +/- 6.8 kPa unit with a stainless steel diaphragm were evaluated in separate tests. These devices provide measurements of water height in the stilling well from which pan evaporation is calculated. Output from the transducers is high-level voltage which can be measured with inexpensive voltage measuring systems. Only normal wiring precautions are needed to transmit the signal to the measurement system. Other applications involving height of a water column may benefit from the present technology, including stilling wells of flow recorders, stream gaging stations, water storage systems, livestock waterers, and spray tank monitors. (Rochester-IVI)
W86-00499

MEASUREMENT OF EVAPORATION AND TRANSPIRATION WITH LYSIMETERS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
N. L. Klocke, D. F. Heermann, and H. R. Duke.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 183-192, January/February, 1985. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Evaporation, *Transpiration, *Evapotranspiration, *Lysimeters, Measuring instruments, Water vapor, Crops, Canopy, Soil water, Water loss, Irrigation.

A project was undertaken to evaluate different methods to measure evaporation (E), transpiration (T), and evapotranspiration (ET) in the field. Measurement techniques were sought for the field using hydraulically weighed lysimeters. The methodology used to obtain E and T measurements and the possible experimental errors associated with these techniques are considered. Sixteen hydraulically weighed lysimeters were studied. Polyethylene film, gravel, and plywood/soil covers were used to suppress soil evaporation from the lysimeters used to measure transpiration. Soil evaporation was measured in uncropped lysimeters that were either shaded or not shaded by the surrounding crop canopy. Summation of the E and T measurements overestimated measured ET by 12% to 24%. Water vapor losses through each of the lysimeter covering materials were measured in the lab. Water vapor conductances were used to estimate the lysimeter cover losses in the field. The water vapor losses through the polyethylene film, gravel and plywood/soil covers in the field were estimated to be 11%, 12%, and 6% of the measured transpiration, respectively. Soil evaporation field data were also adjusted since the crop surrouding the lysimeters for the E measurements had 102 cm rows rather than the 76 cm rows used for the E and T measurements. The summation of the adjusted E and T data were within 1% to 10% of the measured ET. (Baker-IVI)
W86-00501

MODEL TO SIMULATE RESPONSE OF PLANT STOMATA TO ENVIRONMENTAL CONDITIONS,
Hebrew Univ. of Jerusalem (Israel). Seagram Centre for Soil and Water Sciences.
R. Avissar, P. Avissar, Y. Mahrer, and B. A. Bravdo.
Agricultural and Forest Meteorology, Vol. 34, No. 1, p 21-29, February, 1985. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Transpiration, *Stomata, *Simulation, *Model studies, Solar radiation, Leaf temperature, Vapor pressure, Carbon dioxide, Soil water potential.

A semi-empirical model for predicting the stomatal response to solar global radiation, leaf temperature, vapor pressure difference between the leaf and ambient air, ambient air CO2 concentration and soil water potential was developed in order to simulate plant transpiration under different field climatic conditions. In order to determine the different empirical constants needed to run and verify the model, a series of laboratory experiments were

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carried out on Nicotiana Tabaccum var. 'samsun' leaves. The plants were grown in pots in a greenhouse. The model was incorporated in a numerical greenhouse microclimate model. The greenhouse model was run for a typical spring day at the coastal region of Israel. Results obtained are in agreement with those previously published, showing that there is no significant interaction effects between the investigated environmental parameters. The use of a simple model is usually sufficient. (Moore-IVI)
W86-00504

WATER USE EFFICIENCY IN A SOYBEAN FIELD: INFLUENCE OF PLANT WATER STRESS,
National Oceanic and Atmospheric Administration, Oak Ridge, TN. Air Resources Atmospheric Turbulence and Diffusion Lab.
For primary bibliographic entry see Field 2I.
W86-00505

EVALUATING PLANT AND CANOPY RESISTANCES OF FIELD-GROWN WHEAT FROM CONCURRENT DIURNAL OBSERVATIONS OF LEAF WATER POTENTIAL, STOMATAL RESISTANCE, CANOPY TEMPERATURE, AND EVAPOTRANSPIRATION FLUX,
National Aeronautics and Space Administration, Greenbelt, MD. Hydrological Sciences Branch.
For primary bibliographic entry see Field 2I.
W86-00506

EFFECT OF STANDING STUBBLE ON SOIL WATER LOSS BY EVAPORATION,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
J. M. Caprio, G. K. Grundwald, and R. D. Snyder.
Agricultural and Forest Meteorology, Vol. 34, No. 2-3, p 129-144, April, 1985. 6 Fig, 6 Tab, 19 Ref. OWRT project B-046-MONT.

Descriptors: *Evaporation, *Soil water, *Stubble, Fallow, Wind, Turbulent exchange.

To assess the effects of standing stubble on evaporative water loss from wet soil surfaces during the growing season, three mini-lysimeters were installed in each of three treatment areas: fallow (bare soil), half stubble (standing stubble cut to half the height left by the combine), and full stubble (standing stubble at the height left by the combine). During the period from August 28 to September 27, 1978, prewet lysimeters containing a soil mix were set in the field between 4:30 p.m. and 5:00 p.m. The soil in the lysimeters was wet beyond field capacity, but there was no free water on the surface when installed in the field. The following day the lysimeters were removed between 4:30 p.m. and 5:00 p.m. and weighed and the depth of water computed. When rain occurred during an observation period, the data for that period were omitted from the study. Nine suitable observations were obtained from August 28 to September 1 and from September 22 to 27. The average daily evaporation for the 9 days from fallow, half stubble, and full stubble was 6.2 mm, 3.6 mm, and 3.7 mm, respectively. Statistical analyses indicated a difference in evaporation between treatments significant at the 1% level. Evaporation from lysimeters in full stubble as a percent of that from fallow lysimeters averaged 60%, and varied from day to day between about 45% and 75%. Evaporation from fallow lysimeters exceeded that from the evaporation pan by about 25%, a difference that may be attributable to the size of the evaporative surface. The reduced evaporation in stubble as compared with fallow appears to be largely attributable to the reduced wind speed and associated turbulent exchange within the standing stubble. There was a close day-to-day relationship in evaporation between the lysimeters in the various treatments. Evaporation from the half stubble and full stubble lysimeters was highly correlated, as might be expected in view of the similar nature of the two treatments. On the other hand, the relatively lower correlations of the two stubble treatments with fallow suggest that environmental factors influencing evaporation operate differently on fallow fields than on stubble fields. An attempt is made to describe quantitatively how environmental factors might have caused the differences in evaporation between treatments noted in this experiment. (Author's abstract)
W86-00507

ENVIRONMENTAL AND PHYSIOLOGICAL CONTROL OF TRANSPIRATION BY GROUNDNUT CROPS,
Nottingham Univ. (England). Dept. of Physiology and Environmental Science.
S. N. Azam-Ali.
Agricultural and Forest Meteorology, Vol. 33, No. 2/3, p 129-140, December, 1984. 7 Fig, 18 Ref.

Descriptors: *Peanuts, *Transpiration, *Water stress, *Plant population, Stomatal resistance, Boundary layer resistance, Leaves, Seasonal variation, Water deficit, Plant physiology.

In central India, four populations of groundnut were grown to assess the interaction between population and water stress. Transpiration was calculated from measurements or estimates of stomatal resistance, boundary layer resistance, vapor concentration difference between leaf and air, and leaf area index. The frequency distributions of stomatal resistance, boundary layer resistance, vapor concentration difference between leaf and air, and seasonal changes in leaf area index were plotted to analyze the dependence of transpiration rate on each variable, both per unit area of leaf surface, and per unit land surface. For estimates of transpiration per unit area of leaf surface, both stomatal resistance and vapor concentration difference were of similar importance, exerting a far greater influence than changes in boundary layer resistance. However, in terms of transpiration per unit land surface, changes in leaf area index were far more important than in any other variable, particularly late in the season when water was scarce. This study provides further experimental support for estimates of evaporation based on stomatal resistance and allied measurements. The ability of the technique to describe temporal and spatial variations as well as the dominant environmental and physiological influences on transpiration may outweigh any small loss in accuracy of estimates thus obtained. (Author's abstract)
W86-00508

ESTIMATING EVAPORATION: A COMPARISON BETWEEN PENMAN, IDSO-JACKSON, AND ZERO-FLUX METHODS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. M. Sadeghi, H. D. Scott, and J. A. Ferguson.
Agricultural and Forest Meteorology, Vol. 33, No. 2/3, p 225-238, December, 1984. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Evaporation, *Soil water, Estimation, Drainage, Soil surface, Wind, Albedo, Soil matrix potentials.

A field evaporation-drainage study was conducted to compare three methods of predicting evaporative losses from a bare soil. Two of the methods (modified Penman combination and Idso-Jackson) are dependent only on measurements of atmospheric parameters whereas the third method (plane of zero flux) is dependent only on measurements of soil parameters. A Captina soil profile was wet up and allowed to dry by evaporation and drainage. For the initial two days after infiltration ceased all three methods predicted similar evaporative losses. Differences between the three methods occurred when the soil moisture content at the soil surface controlled the evaporation rates. Under the three drying conditions the three methods behaved somewhat differently in the prediction of the amounts of water evaporated from the soil surface. Lower losses by evaporation were predicted by the Idso-Jackson and zero-flux methods. In the case of the Idso-Jackson method this result was attributed to the influence of clouds on albedo, the impact of wind and the importance of albedo in the predictive equation. For the zero-flux method the decrease in evaporation was due to the lower soil water contents and matrix potentials near the surface which resulted in lower transport rates of water to the surface. (Author's abstract)
W86-00509

EVAPORATION FROM WET SOIL SURFACES BENEATH PLANT CANOPIES,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
G. K. Walker.
Agricultural and Forest Meteorology, Vol. 33, No. 2/3, p 259-264, December, 1984. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Soil surface, *Evaporation, *Canopy, Corn, Sensible heat, Leaves, Heat transfer.

In studies of latent heat flux from vegetated surfaces, it is often desirable to separate evaporation from the soil surface and transpiration by the vegetation. Concurrent measurements of the net radiation and evaporation from the soil surface beneath maize canopies were made for 24-hour periods during which the soil surface remained wet. Evaporation from the soil surface often exceeded the radiant energy supply, indicating a downward flux of sensible heat. This effect was greater beneath a denser canopy. The highest value for the sensible heat component, 0.86 MJ/sq m/d, is equivalent to 0.35 mm H2O/d. The production of sensible heat at foliage elements, and its transport to the soil surface, may be important processes in overall canopy energy partitioning. Empirical methods of evaporation estimation from the soil surface beneath a canopy may not be successful under conditions where evaporation depends substantially on heat produced in the canopy and transported to the soil surface. (Moore-IVI)
W86-00510

TRANSPIRATION FROM A KIWIFRUIT VINE AS ESTIMATED BY THE HEAT PULSE TECHNIQUE AND THE PENMAN-MONTEITH EQUATION,
Ministry of Works and Development, Palmerston North (New Zealand).
W. R. N. Edwards, and N. W. M. Warwick.
New Zealand Journal of Agricultural Research, Vol. 27, No. 4, p 537-543, 1984. 3 Fig, 21 Ref.

Descriptors: *Transpiration, *Heat pulse velocity, *Kiwifruit vine, *Penman-Monteith equation, Air temperature, Vapor pressure, Wind, Stomatal conductance.

Heat pulse velocities were measured at 4 depths in the stem of a kiwifruit plant (Actinidia chinensis Planchon) throughout one late-autumn day, and sap velocities and total stem sap flux were calculated from physical principles without restoring the empirical calibration. Concurrent measurements of net radiation, air temperature, vapor pressure deficit, wind speed, and stomatal conductance were utilized in a second, independent calculation of transpiration based on the Penman-Monteith combination equation. Results indicated that most flow occurred in the outer ring or rings of the stem xylem tissue, and there was a close relationship between fluxes estimated by the 2 methods. Heat pulse velocity measurement is potentially a practicable method for measuring transpiration rates in kiwifruit. (Author's abstract)
W86-00516

2E. Streamflow and Runoff

REPORT OF FRESHWATER MOLLUSKS WORKSHOP, MAY 19-20, 1981.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6G
W86-00329

HABITAT DEVELOPMENT FOR FRESHWATER MOLLUSKS IN THE TOMBIGBEE RIVER NEAR COLUMBUS, MISSISSIPPI,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 8I.
W86-00330

FF REDUCTION BY VENTING WITH
LOW SUBSURFACE DRAINAGE,
lvania State Univ., University Park.
reckenridge, A. R. Jarrett, and J. R.
.
ctions of the American Society of Agricul-
ngineers, Vol. 28, No. 2, p 476-479, March/
985. 5 Fig, 22 Ref. OWRT project A-052-

tors: *Soil properties, *Runoff, *Infiltra-
Subsurface drainage, Permeability, Soil
Rain, Rainfall-runoff relationships, Drain-
l air.

ensity of a rainfall event, in relation to the
filtration capacity, determines how much
er will enter the soil as infiltration. A layer
permeability within the soil profile can
infiltration if the soil air ahead of the wet-
nt is not vented. The effect of entrapped
on the rainfall-runoff relationship was in-
ed in a soil with an impervious layer within
le. When the air in the soil was not vented
ain placed just above the impervious layer,
tration rate was reduced from 14 to 73%,
ng on the size and distribution of soil pores.
surface soil dried and cracked, the soil air
until the cracks filled with water. In these
still remaining within the soil profile was
which reduced the infiltration rate after
ks no longer vented air. The influence of
f disturbed soil on trapped soil air and the
runoff relationship was also evaluated. The
of voids at the beginning of tests on shal-
turbed soil was less than on deeply dis-
oil. The larger amount of voids associated
deeper disturbed soil resulted in increased
on rates for a period near the start of rain;
r, the larger volume of trapped air resulted
icantly greater volume of runoff. (Baker-

471

roundwater

GEOLOGICAL AND GEOTECHNICAL
TS OF THE TENNESSEE-TOMBIGBEE
WAY,
f Engineers, Mobile, AL. Mobile District.
nary bibliographic entry see Field 8E.
34

TERING THE DIVIDE CUT OF THE
SSEE-TOMBIGBEE WATERWAY; A
CHALLENGE TO CONSTRUCTION,
ngineer District, Nashville, TN.
nary bibliographic entry see Field 8D.
35

LOGY, HYDRAULIC, AND SEDIMENT
ERATIONS OF THE TENNESSEE-
GBEE WATERWAY,
f Engineers, Mobile, AL. Mobile District.
nary bibliographic entry see Field 6G.
36

DWATER MONITORING AND
E BIAS,
Univ. (Ontario). Dept. of Earth Sciences.
ary bibliographic entry see Field 7B.
45

DWATER DEVELOPMENT, KHARGA
WESTERN DESERT OF EGYPT: A
ERM ENVIRONMENTAL CONCERN,
aux (P.E.) and Associates, Inc., Tuscaloo-

ary bibliographic entry see Field 4B.
54

MINATION OF STORAGE CHARAC-
ICS AND DYNAMIC STRATA PARAM-
THROUGH TEST WELLS (BESTIM-
VON SPEICHEREIGENSCHAFTEN
DYNAMISCHEN SCHICHTPARAME-
URCH TESTARBEITEN),
Forschungsinstitut fuer die Erkundung Foerderung von Erdoel und Erdgas, Gommern (German D.R.).
H.-D. Voigt, and A. Astl.
Zeitschrift fur Geologische Wissenschaften, Vol. 13, No. 1, p 95-101, 1985. 5 Fig, 6 Ref.

Descriptors: *Well tests, *Groundwater storage, Drawdown, Pressure, Permeability, Hydrogeology, Geological fractures, Groundwater reservoirs.

During the test of wells, pressure drawdown and pressure buildup curves are measured, from which permeability, reserve of drainage and static pressure are determined. These curves in different ways are influenced by diverse reservoir heterogeneities, thus the particular heterogeneity may be determined by the form of the recorded curves. The identification of the reservoir heterogeneities is presented for the following four examples: - sealing faults - local changes of permeability - local natural fracturing of a reservoir - layered character of a reservoir. Such interpretation should be carried out taking into account all geological information to obtain reliable results. (Author's abstract)
W86-00587

2G. Water In Soils

PHYSICAL CHARACTERISTICS OF SOILS IN THE SOUTHERN REGION: CECIL,
R. R. Bruce, J. H. Dane, V. L. Quisenberry, N. L. Powell, and A. W. Thomas.
Southern Cooperative Series Bulletin 267, December, 1983. 185 p, 25 Fig, 82 Tab, 7 Ref.

Descriptors: *Soil profiles, *Soil water, *Permeability coefficient, *Soil surveys, *Soil physical properties, *Soil water potential, *Soil moisture retention, *Baseline studies, Soil properties, Soil horizons, Data collections, Cecil soil, Water pressure, Pore pressure, Core logging, Drainage, Alabama, Georgia, South Carolina.

As part of the Southern Regional Project S-124, in situ measurements of soil water pressure and soil water content were made in all horizons of pedons of Cecil soil in Auburn, Alabama, Watkinsville, Georgia, Clemson, South Carolina, and Blacksburg, Virgina at intervals of time during a drainage period of at least 20 days. Water retention was measured on undisturbed soil cores obtained from all horizons at 15 sampling sites. Results were used to compute unsaturated hydraulic conductivity as a function of soil water content over the range experienced during the drainage interval. The extensive soil water pressure data as a function of time and depth and the large amount of soil water content data along with information on other physical characteristics provides an excellent basis for the study of soil water retention and transport in Cecil soil and similar soil bodies.
W86-00343

COMPUTER SIMULATION OF A SPACE SAR USING A RANGE-SEQUENTIAL PROCESSOR FOR SOIL MOISTURE MAPPING,
Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
M. Fujita, and F. T. Ulaby.
Available from the National Technical Information Service, Springfield, VA 22161 as N82-32796. RSL Technical Report 551-1, April 1982. 99 p, 24 Fig, 13 Tab, 9 Ref, append. Contract/Grant No. NAS 9-26429.

Descriptors: *Simulation, *Computers, *Radar, *Soil moisture, *Mapping, Computer models, Remote sensing, SAR, Telemetry.

In this report, the ability of a spaceborne synthetic-aperture radar (SAR) to detect soil moisture is evaluated by means of a computer simulation technique. The computer simulation package includes coherent processing of the SAR data using a range-sequential processor, which can be set up through hardware implementations, thereby reducing the amount of telemetry involved. With such a processing approach, it is possible to monitor the earth's surface on a continuous basis, since data-storage requirements can be easily met through the use of currently available technology. The development of the simulation package is described first, followed by an examination of the application of the technique to actual environments. The results indicate that in estimating soil-moisture content with a four-look processor, the difference between the assumed and estimated values of soil moisture is within +/- 20% of field capacity for 62% of the pixels for agricultural terrain and for 53% of the pixels for hilly terrain. The estimation accuracy for soil moisture may be improved by reducing the effect of fading through noncoherent averaging.
W86-00351

INFILTRATION AND SOIL WATER DISTRIBUTION IN LAYERED SOILS COMPUTED BY GREEN AND AMPT AND RICHARDS MODELS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
R. R. Bruce, and A. W. Thomas.
Presented at the 1983 Winter Meeting of the American Society of Agricultural Engineers, Paper No. 83-2501, December 13-16, 1983, Chicago, IL., 18 p. 14 Fig, 2 Tab, 22 Ref.

Descriptors: *Soil water, *Infiltration, *Soil horizons, *Model studies, *Soil profiles, *Permeability coefficient, *Soil moisture retention, *Mathematical models, Hydrologic models, Prediction, Mathematical studies, Water pressure, Pore pressure, Models.

Experience in estimating infiltration and soil water distributions by Richards, and Green and Ampt models for soils having a range in horizon characteristics is reported. The determination of appropriate hydraulic characteristics for each of three soil horizons, varying from 5 to 40 percent clay, for three soil series received major attention. The effect of magnitude and imcompatibility of soil water retention and hydraulic conductivity characteristics, at matric potentials greater than -1.5 or -2.0 kPa, upon cumulative infiltration is shown. Calculations of cumulative infiltration by the Richards model, both by changes in soil water content profile and by changes in flux, were useful in detecting data incompatibility. The results computed by each model are equally dependent on the reliability of input data for the wet range. Estimates of infiltration by the two models into Cecil, Norfolk and Gardena soil profiles, composed of surface and subsoil horizon, were similar when estimates of infiltration into the uniform systems of each of the horizons were demonstrated to be similar. When reliable estimates of infiltration were made, the rectangular wetting front predicted by the Green and Ampt model intersected that predicted by the Richards model at about one-half the soil water content range of the particular horizon. (Author's abstract)
W86-00377

GROWTH AND WATER USE OF TALL FESCUE AS INFLUENCED BY SEVERAL SOIL DRYING CYCLES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W86-00459

OVERWINTER SOIL MOISTURE CHANGES,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
D. M. Gray, R. J. Granger, and G. E. Dyck.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 442-447, March/April, 1985. 6 Fig, 2 Tab, 38 Ref.

Descriptors: *Soil water, *Seasonal variation, Temperature, Freezing, Thawing, Snowmelt, Irrigation effects, Infiltration.

Moisture migration in response to a temperature gradient during freezing and thawing of unsaturated soils is a complex process involving the thermodynamics of the soil-ice-water regime. Field studies

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of the changes in the moisture regimes of some soils in the Canadian Prairies during winter show significant fluxes of moisture migration to the freezing front in both irrigated and dryland areas. The magnitudes of the fluxes are directly related to the moisture content and are greatest in the lighter-textured, irrigated soils having a water table at a relatively shallow depth. In soils which are dry in the fall the net change in the moisture status due to freezing is negligible. Overwinter moisture losses from the soil layer 0-300 mm are most common whereas gains are most frequent in a 1 m depth. The overwinter changes in the surface were independent of the moisture content at freeze-up and the average soil temperature gradient in the zone during the 60 d period following freeze-up. In dryland areas, moisture changes in a 1 m depth due to migration represent, on the average, 50% of the total seasonal change (snowmelt infiltration plus overwinter change). (Baker-IVI)
W86-00466

RUNOFF REDUCTION BY VENTING WITH SHALLOW SUBSURFACE DRAINAGE,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 2E.
W86-00471

THREE-DIMENSIONAL INFILTRATION AND TRICKLE IRRIGATION,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W86-00474

FURROW COMPACTION FOR CONTROLLING EXCESSIVE IRRIGATION WATER INTAKE,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 3F.
W86-00475

INFILTRATION UNDER SURGE IRRIGATION,
Everglades Research and Education Center, Bella Glade.
For primary bibliographic entry see Field 3F.
W86-00478

HYDRAULIC POTENTIAL IN UNFROZEN SOIL IN RESPONSE TO DIURNAL FREEZING AND THAWING OF THE SOIL SURFACE,
Agricultural Research Service, Pendleton, OR. Columbia Plateau Conservation Research Center.
J. L. Pikul, Jr., and R. R. Allmaras.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 164-168, January/February, 1985. 6 Fig, 21 Ref.

Descriptors: *Soil physical properties, *Hydraulic potential, *Freezing, *Thawing, Frost, Soil water, Temperature, Crops, Vegetation effects, Microclimate.

Sub-surface hydraulic potential changes during daily freezing and thawing of soil surface were measured. The strong influence that crop residue cover has on the daily soil freezing and thawing phenomenon was demonstrated. Surface residue influence the formation of soil frost during late winter freezing and thawing cycles. During 7 consecutive diurnal freezing and thawing cycles in March, soil frost did not form under standing stubble. A bare surface froze to about 1.5 cm during each freezing night. When the soil surface (2 cm) was wet (0.34 cu m/cub m), water moved readily from subsurface layers to the freezing front. During one 6 hr freezing period, volumetric water content increased from 0.31 to 0.57 cu m/cu m at a depth of 0.25 cm. As the soil dried (0.22 cu m/cu m), water movement to the surface became negligible. Hydraulic potential at 2 cm decreased 11.4 kPa during one 7-hr freezing period on 21 March. At 13 cm, diurnal fluctuations of hydraulic potential were nearly damped out. Hydraulic potential during the 7 day period characterized water evaporation from the profile rather than drainage. Soil water evaporation was greater from the bare surface plot than from a standing stubble plot. During one 24 hr period, the bare and stubble-covered plots lost 2.4 and 0.3 mm of water, respectively, from the top 11 cm of soil. High water losses from the bare surface plot should not be considered a consequence of freezing induced water movement only. The surface cover on each plot creates a unique microclimate with different energy and radiation budgets. (Baker-IVI)
W86-00498

EVALUATING THE EFFECT OF INCREASED CONCENTRATION OF CO2 ON INFILTRATION RATE,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
A. R. Jarrett, and J. R. Hoover.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 179-182, January/February, 1985. 4 Fig, 15 Ref. OWRT project A-051-PA.

Descriptors: *Infiltration, *Carbon dioxide, *Soil water, *Hydraulic gradient, Fluid mechanics, Soil properties.

A determination was made as to whether the reduction in infiltration rates observed in soils when the natural soil air is trapped ahead of the wetting front can be reduced or eliminated by replacing the natural soil gas with carbon dioxide. The processes involved in infiltration enhancement with carbon dioxide were also investigated. The carbon dioxide gas was free to escape from ahead of the wetting front, the hydraulic conductivities were increased causing the infiltration rates to be 50% higher in the sand and 56% higher in the loam after 500 s of infiltration than those observed in identical tests using natural soil air in the same two soils. When the carbon dioxide gas was trapped ahead of the wetting front, the effect of the increased hydraulic conductivities was nullified in the sand thus reducing the infiltration rate to values as low as or lower than when the air was trapped. When the carbon dioxide gas was trapped in the loam soil during infiltration, the infiltration rate remained as high as when the carbon dioxide gas was not trapped because the exchange of hydrogen ions for calcium ions in the wetted zone increased the water filled porosity in the wetted zone by 38% thus increasing the hydraulic conductivity which increased the infiltration rates. The hydraulic gradient at the wetting front was also increased due to the reduced gas pressure. The infiltration rates increase when soil gas is provided an easy escape path. When soil air cannot be vented mechanically, practices designed to elevate the carbon dioxide levels in the soil have been shown to effectively increase the infiltration rate. Such practices include keeping soil calcium and soil carbon dioxide levels high through maintaining living, healthy cover crops. (Baker-IVI)
W86-00500

CORN YIELD VARIATION AS RELATED TO SOIL WATER FLUCTUATION AND NITROGEN FERTILIZER. I. SOIL WATER-YIELD RELATIONSHIPS,
Department of Agriculture, Quebec. Research Station.
D. Isfan.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 10, p 1147-1161, September, 1984. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Soil water, *Corn, *Crop yield, Forecasting, Available water, Rainfall.

The objective of this work was to study the effect of plant available soil water (PAW) in different soil layers before and during the growing season on corn yields (Zea mays L.) and to determine if the soil water may be a reliable index in forecasting the grain yield. The experiments were carried out for 10 years at the same site on a deep-permeable well-drained chernozem with good physico-chemical and biological properties situated in a temperate-continental dry climate with annual precipitation of about 500 mm and wide seasonal and annual fluctuation. The results show that the maximum yields (MY) were highly correlated to w
stored in the soil as well as at the beginnin
during the growing season. In most cases the y
were better correlated to PAW at the beginni
June (r = 0.96) than at the beginning of Mar
= 0.87) or July (r = 0.91). Nevertheless, the
PAW was more efficient in terms of yield per
of PAW. Thus, 1 mm of PAW within 0-150 c
March, June and July 1st increases the MY b
21 and 30 kg/ha of grain, respectively. The
was more related to March and especially to
1st PAW (0-150 cm) than to June-July preci
tion. The PAW from deeper soil layers w
almost all cases better correlated with MY
more efficient. Thus, for the PAW within 0-7
on March, June and July 1st the simple correl
coefficients with yields were 0.69, 0.87 and
respectively while for the PAW within 0-15
the correlation coefficients were 0.87, 0.96 and
respectively. Also, 1 mm of PAW within 0-10
on March, June and July 1st increased the y
by 23, 34 and 39 kg/ha while the PAW within
150 cm increased the yields by 40, 56 and 78 k
respectively. The results suggest that in this
area the amount of yield is higly related to PA
the beginning as well as during the growing se
and that soil water may be a good index
forecasting yields as early as three month pri
harvest, except for years with weather accider
late summer. They also show that PAW
deeper soil layers has a paramount effect on
mum corn yield. (Author's abstract)
W86-00514

**CORN YIELD VARIATION AS RELATED
SOIL WATER FLUCTUATION AND NI
GEN FERTILIZER. II. SOIL WATER-NI
GEN-YIELD RELATIONSHIPS,**
Department of Agriculture, Quebec. Research
tion.
D. Isfan.
Communications in Soil Science and Plant A
sis, Vol. 15, No. 10, p 1163-1174, September,
7 Fig, 1 Tab, 12 Ref.

Descriptors: *Corn, *Crop yield, *Soil water,
trogen, *Fertilizers, Available water, Multip
gression analysis, Forecasting, Water use eff
cy.

The aim of this study was to determine the
tionships between soil water and nitrogen fer
and their effect on grain corn yield (Zea may
in a zone where the limiting factor of yield
nitrogen efficiency is the water supply. The e
ments were carried out for 10 years on a
permeable well-drained chernozem in a tempe
continental dry climate with annual precipit
of about 500 mm. Different nitrogen rates
applied and plant available soil water (PAW
determined every year before and during
growing season. Multiple regressions were
for nitrogen rate, soil water and corn yield.
results show that there is a significant intera
between soil water content, applied nitroge
corn yield. The soil water explains the gr
part of yield variation, followed by the soil w
added nitrogen interaction effect and the
effect of added nitrogen. The PAW on Jul
gave a better correlation (R2 = 0.88) than Ju
(R2 = 0.85) on March 1st PAW (R2 = 0.72)
the best correlation was obtained when both
and July PAW were taken together in the re
sion (R2 = 0.914). July PAW was also
efficient in terms of yield per PAW. Thus, 1 m
PAW on March, June and July 1st increase
control yield by 12.5, 14.6, and 18.3 kg gra
respectively, and by 18.0, 22.0 and 32.0 kg g
ha for the fertilized yield (with 60 kg N/ha
low soil moisture content, the applied N had
even negative effect on water use efficienc
yield while at high PAW the water use effic
was greatly increased by the applied N. (Au
abstract)
W86-00515

2H. Lakes

**PRELIMINARY GUIDE TO THE ON
IDENTIFICATION AND DELINEATION**

E WETLANDS OF THE NORTH ATLANTIC ITED STATES,
ny Engineer Waterways Experiment Station, ksburg, MS. Environmental Lab.
T. Huffman, G. E. Tucker, J. W. Wooten, C. V. mas, and M. W. Freel.
chnical Report Y-78-8, May 1982. Final Report. , 5 Fig, 81 Ref, 1 Append.

scriptors: *Wetlands, *Hydrology, *Vegetation, il-water-plant relationships, *Plant populations, gs, Swamps, Marshes, Lakes, Aquatic habitats, atic plants, Glacial soils, Bottomland, Flood ns, Saline water, Forests, Streambeds, Shores.

s guidebook is intended to help regulatory per- nel with the onsite recognition and geographi- delineation of wetland boundaries in the North antic United States. The introduction includes eral information about wetlands. Major low- l areas are the Seaboard Lowlands of New gland, the Ontario Plain in New York, and the e-river valleys: Connecticut, St. Lawrence, hawk, and Hudson. Numerous ponds, lakes, mps, and bogs exist as a result of impervious erlying rock, coarse acidic soils, and glaciation cts. Climatic parameters are highly variable. vever, inland areas are usually cool and humid an average of 102 cm of precipitation each . Tropical storms have caused major damage outheastern New England forests. Indicators described for determining whether vegetation, and hydrological conditions are typically wet- . Wetlands are classified into several groups, with characteristic vegetation. Aquatic bed lands have vegetation which grows on or w the water surface for most of the growing on. Emergent wetlands have erect, rooted, her- ous hydrophytes (excluding mosses and li- s), mostly perennial. Scrub-shrub wetlands forested wetlands have woody vegetation less 6 m high. The streambed class includes nonti- channels containing water for part of the year. onsolidated shores have unconsolidated sub- es, 30% or less vegetation cover, flooded mittently.
-00316

NTHIC MACROINVERTEBRATES OF SE- CTED AQUATIC HABITATS OF THE VER MISSISSIPPI RIVER,
y Engineer Waterways Experiment Station, ksburg, MS. Environmental Lab.
. Beckett, C. R. Bingham, L. G. Sanders, D. lathis, and F. M. McLemore.
nical Report E-83-10, April 1983. Final ort. 79 p, 15 Fig, 15 Tab, 43 Ref, 2 Append.

criptors: *Aquatic insects, *Macroinverte- es, *Aquatic animals, *Aquatic habitats, nthos, Floods, Mississippi River, River flow, er currents, Mud, Silt, Sand, Gravel.

hic macroinvertebrates distribution in four tic habitat types (a natural bank, secondary nel, an abandoned channel, and dike fields) in a 60-mile reach of the lower Mississippi r over one high flow (flood stage), two mod- and two low flow periods between April and September 1980 is described. The biotas ent in the natural bank and in the secondary abandoned channels showed only minor ges in composition over the various flow re- s. The natural bank was consistently dominat- numerically) by the burrowing mayflies Torto- incertus and Pentagenia vittigera and hydrop- id caddisflies. The consistently most common in the secondary channel were the sand-dwell- chironomids Robackia claviger and Chernovs- orbicus. Phantom midges, tubificid oligo- tes, and fingernail clams were always the most dant macroinvertebrates in the abandoned nel. Macroinvertebrate densities were always in the mud-bottomed abandoned channel and always low in the secondary channel. The fields showed large changes in biotic composi- which correlated with changes in river stage resultant alterations in current and substrate. decreased river stages, substrate dominance ged from erosional (sand and gravel) to depo- nal (silt). It is concluded that the distribution nacroinvertebrates in the Lower Mississippi River habitats is a function of the physical characteristics (current velocity and substrate composition) of the system. (Author's abstract modified)
W86-00324

INSTRUCTION REPORT ON FRESHWATER MUSSELS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. C. Miller, and D. A. Nelson.
Instruction Report EL-83-2, September 1983. Final Report. 198 p, 22 Fig, 42 Tab, 394 Ref.

Descriptors: *Mussels, *Bivalves, *Mollusks, Commercial fishing, Relocation, Reviews, Sampling, Computer program, Habitats.

This report contains information on the following topics: collecting, preserving, and identifying freshwater mussels; methods for relocating and creating habitat for mussels; the commercial shell industry; and the technical literature concerning mussels. This information will aid in performing impact assessments and endangered species surveys. Techniques for determining the number of samples required to provide a fairly accurate estimate of a population mean are discussed. The simplest and fastest is to calculate cumulative means for a particular species collected in a series of samples. The resulting curve will eventually stabilize near the mean of the population. A more accurate technique is to conduct a pilot survey, determine the average and standard deviation of the sample, and decide what degree of precision is required. Based upon the pilot survey, it is possible to make an estimate of the number of samples needed to satisfy the particular criteria desired. The diversity of the habitat and likelihood of capturing additional, less common, species can be determined by plotting cumulative species versus cumulative individuals. A computer program has been developed which can provide assistance in determining the number of samples required. The program can simulate cluster, random, or uniform distribution patterns. Using random numbers, the program then 'samples' the array and calculates sample means and standard deviation.
W86-00325

VERIFICATION AND TRANSFER OF THERMAL POLLUTION MODEL; VOLUME IV: USER'S MANUAL FOR THREE-DIMENSIONAL RIGID-LID MODEL,
Miami Univ., Coral Gables, FL. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5B.
W86-00346

USE OF VEGETATION IN DELINEATING WETLAND BORDERS IN UPPER MISSOURI RIVER BASIN; NORTH-CENTRAL UNITED STATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. C. Johnson, R. A. Mayes, and T. L. Sharik.
Technical Report Y-82-1, Army Engineer Waterways Experiment Station, Vicksburg, MS., August 1982. Final Report. 132 p, 15 Fig, 5 Tab, 14 Ref, 3 Append. Contract/Grant No. DACW39-78-C-0098.

Descriptors: *Wetlands, *Vegetation, *Transition zone, *Sampling, *Upper Missouri River Basin, Species composition, Species diversity, Plant populations, Graphical analysis, South Dakota.

Wetland-nonwetland transition zones in the Missouri River Basin of the North-central United States were studied in seven wetlands ranging in size, permanence, and salinity to develop an efficient sampling methodology that utilized vegetation data to delineate wetland boundaries. One hundred and sixty species of vascular plants occurred in twenty sample transects. Sampling methodology suggested for use in the study area (200-km radius of Sioux Falls, South Dakota) is a combination of the belt transect method (contiguous quadrants) to estimate cover by species and a cover board to measure vertical structure. The methods require a combined sampling time of about 9 minutes/m of transect, corresponding to a sampling time of 3.2 hr for a transect of average length. A streamlined methodology was also devised whereby sampling time could be cut in half. General upper and lower borders of the transition zone were determined from direct gradient analysis graphs. Specific borders were determined from the occurrence of compositional dichotomies displayed in ordination models. The upper border of the transition zone is suggested as the most probable wetland border. This border appears to represent the upper limit of disturbance from wetland processes (siltation during drawdown, ice scouring, variable surface and subsurface hydrologic regime). The transition zone (between emergent aquatic and low prairie zones) is strongly influenced by wetland disturbances and, therefore, contains a large proportion of opportunistic, ruderal species. The lower border of the transition zone is highly variable annually, while the upper border appears to be relatively stable.
W86-00359

INFLUENCE OF THE FISH CLARIAS BATRACHUS ON THE PHYSICOCHEMICAL PROPERTIES OF WATER UNDER LABORATORY CONDITIONS,
Kalyani Univ. (India). Dept. of Zoology.
B. B. Jana, M. Sinha, and S. Gupta.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 107-113, 1984. 2 Tab, 11 Ref.

Descriptors: *Physicochemical properties, *Fish, *Nutrients, Aquaculture, Fish farming, Phosphorus, Nitrogen, Chlorides, Hydrogen ion concentration, Carbon dioxide, Dissolved oxygen.

An attempt is made to measure the changes of physicochemical characteristics of water affected by the different metabolic states of Clarias batrachus under laboratory conditions, as part of a study into production of air-breathing fish. A distinct acidic environment in the water of experimental aquaria was encountered because the values of pH and free CO2 were markedly different between the experimental aquaria and the control. There was a reduced level of oxygen in the experiment aquaria compared to the control. The variations of pH and free CO2 among experimental variants were very minor and could not be accounted for by the differences in the metabolic states of fish. The chloride input through fish excrement in the larger and fed fishes may be much higher compared to the smaller and starved fishes. Food pellets were an important source of chloride in the water. The phosphate content in the experimental aquaria was significantly higher than in the control, which suggests that a significant phosphate loading was ocurring in these aquaria mainly through the droppings of fish. The nitrogen excretion rate was distinctly higher in the large fishes of Clarias batrachus than in their smaller counterparts and these carnivorous fishes have a major role in the nitrogen input of the habitat. The population of heterotrophic and ammonifying bacteria was distinctly higher in the aquaria with large fed fishes compared to other groups of fishes. (Baker-IVI)
W86-00401

CHEMICAL AND PHYSICAL CHARACTERISTICS OF SOME WETLAND WATERS OF KASHMIR,
Kashmir Univ., Srinagar (India). Dept. of Botany.
S. Kaul, and C. L. Trisal.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 137-144, 1984. 2 Fig, 1 Tab, 15 Ref.

Descriptors: *Jammu and Kashmir, *India, *Wetlands, *Physicochemical characteristics, Nutrients, Carbon dioxide, Water temperature, Vegetation, Seasonal variation, Dissolved oxygen, Calcium, Magnesium, Alkalinity, Nitrogen.

Ecosystem analyses of five important wetlands in the Kashmir Valley have been undertaken. The annual cycle of the surface water temperature in the study sites showed a close relationship to that of air temperature. The temperature increased from a spring low to a summer high followed by a decrease until minimum values are recorded in

winter. Oxygen values showed an inverse relationship to temperature. Of the divalent ionic components in different wetland sites, Ca and Mg are the most abundant. The concentration of free carbon dioxide is very low, the dissolved inorganic carbon necessary for photosynthesis being obtained from bicarbonates. The wetland waters are alkaline with pH ranging between 7.2 and 9.6. NO3-N is the most abundant nitrogen source at the present sites. The increase in NO3-N concentration towards winter and early spring may be attributed to the combined result of nitrification at the mud-water interface and the vigorous stirring of wetland waters which eliminates any limiting effects of oxygen diffusion. Both NO2-N and NH3-N are present in low amounts in comparison to NO3-N. In all the five wetlands the time variation and station differences are highly significant. There were however, two exceptions: the site difference was not significant for the water temperature, and time variation, site differences and station differences were not significant in case of alkalinity. (Baker-IVI)
W86-00405

INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Bezirks-Hygieneinspektion und -Inst., Potsdam (German D.R.).
For primary bibliographic entry see Field 5B.
W86-00406

PROBLEM OF INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (ZUR FRAGE DER KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Institut fuer Binnenfischerei, Berlin (German D.R.).
For primary bibliographic entry see Field 5B.
W86-00407

INVESTIGATIONS ON THE INFLUENCE OF LIMNIC MACROPHYTES ON THE DYING RATE OF ESCHERICHIA COLI IN WATER (UNTERSUCHUNGEN ZUM EINFLUSS LIMNISCHER MAKROPHYTEN AUF DIE ABSTERBEGESCHWINDIGKEIT VON ESCHERICHIA COLI IM WASSER),
Medizinische Akademie 'Carl Gustav Carus' Dresden (German D.R.).
G. Burger, and G. Weise.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 301-309, 1984. 5 Fig, 5 Tab, 9 Ref.

Descriptors: *Escherichia, *Macrophytes, *Antibacterial action, Bioassay, Aquatic plants, Bacteria.

In bioassays in aquaria, the death of Escherichia coli was accelerated by the presence of Glyceria maxima, Schoenoplectus lacustris, Alisma plantago-aquatica and Mentha aquatia as compared with check tanks without any plants (initial concentration 15 x 10 to the 9th colony-forming units per ml). As expected, the antibacterial effect of the limnic macrophytes attains it maximum effectiveness within the first days of the period of investigation. The 90% reduction time is shortened by one third to half, and the 99% reduction time is shortened by one fourth to one third. Mean contact times of 7-11 h are required for the decimation of bacteria by 90% and mean contact times of 16-19 h are necessary for a 99% reduction of the population. The antibacterial effect in mixed stands of different plant species possibly increases additively or superadditively. (Author's abstract)
W86-00414

STUDIES ON PRIMARY PRODUCTIVITY AND SOME HYDROCHEMICAL ASPECTS OF A POLLUTED WATER-BODY OF THE HIMALAYAN JHELUM VALLEY,
Jos Univ. (Nigeria). Dept. of Botany.
M. A. Khan.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 539-548, 1984. 8 Fig, 23 Ref.

Descriptors: *Primary productivity, *Lakes, *Jhelum Valley, *Jammu and Kashmir, India, *Trigamsar, Stratification, Temperature, Seasonal variations, Visibility, Turbidity, Phytoplankton, Eutrophication.

The Valley of Kashmir is a lacustrine basin of the inter-montane depression existing between the Lesser and the Great Himalaya. A study was undertaken of the culturally polluted lake Trigamsar for a period of 22 months to evaluate the seasonal variations in the hydrobiological features and to evaluate relationships between the biota and the habitat. During the summer, the surface water temperatures reach as high as 30 C with a sharp decline in the deeper layers. These relatively high temperature values are due to the absorption of heat by the biogenic turbidity of Trigamsar. The oxygen concentration in the suface water varied between 7.6 and 14.5 mg/l throughout the study period. Despite the shallow basin, Trigamsar develops a significant vertical oxygen gradient during March-October. During summer the waterbody was characterized by a typical clinograde oxygen curve indicative of an accelerated eutrophication of the ecosystem. The surface lake water remained supersaturated with oxygen during the greater part of the year. The pH ranged from 8.1 to 9.9 and total alkalinity was principally of the bicarbonate type and fluctuated between 345 and 480 mg/l. Secchi transparency ranged from 0.25 to 0.60 m during the study with higher values being obtained during the winter and the minimum in summer. Lake water is quite turbid. A pronounced seasonal cycle in the phytoplankton production was observed which closely paralleled the seasonal cycle of temperature and light. The values for the photosynthetic efficiency in the water body fluctuated between 0.42 and 2.85% with higher values obtained during summer and the lowest in winter. The phytoplankton population of the Trigamsar was predominantly of Cyanophyceae followed by Chlorophyceae and Bacillariophyceae. (Baker-IVI)
W86-00420

SENSITIVITY OF SOUTHERN QUEBEC LAKES TO ACIDIC PRECIPITATION,
Quebec Univ., Sainte-Foy.
For primary bibliographic entry see Field 5C.
W86-00427

SEDIMENT ACID NEUTRALIZATION IN SOFTWATER LAKES,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
L. A. Baker, P. L. Brezonik, E. S. Edgerton, and R. W. Ogburn, III.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 215-230, 1985. 7 Fig, 5 Tab, 36 Ref.

Descriptors: *McCloud Lake, *Florida, *Lake sediments, *Acidity, *Neutralization, Softwater lakes, Sediments, Calcium, Magnesium, Volatile solids, Storm seepage, Acidification.

The mechanisms and potential magnitude for sediment acid neutralization in softwater lakes was examined. The principal site for this study was McCloud Lake, a small softwater lake in Florida. The lake and its watershed receive minimal human disturbance. The lake is a simple shallow doline that does not stratify thermally and has no inlet or outlet. The lake received 90% of its water from rainfall during 1981-82 and the remainder from subsurface seepage. The littoral sediments are sand interspersed with pockets of peaty material, while the profundal sediments are a highly organic ooze up to 6 m thick. Sediments from seven other lakes in Wisconsin and Florida were used for comparison purposes. Acid neutralizing capacities of sediments from these lakes were as high as 10 meq/100 g over the pH range 4.5 to 5.5 in well mixed batch experiments. Exchange of Ca(2+) and Mg(2+) accounted for over 50% of the neutralizing capacity. Al solubilization and sulfate adsorption were unimportant in neutralizing H(+) additions. Acid neutralizing capacity was correlated with sediment volatile solids content. Sulfate reduction occurred in microcosms that simulated lake-water interactions and subsurface seepage. In situ pore water profiles and a whole-like mass balance confirm the occurrence of this process in McCloud Lake. Se ment neutralization is important for lakes that ceive most of their water from precipitation thus are particularly susceptible to acidificati (Baker-IVI)
W86-00432

ARTICULATION, ACCURACY AND EFFI TIVENESS OF MATHEMATICAL MODELS REVIEW OF FRESHWATER WETLAND PLICATIONS,
Louisiana State Univ., Baton Rouge. Center Wetland Resources.
R. Costanza, and F. H. Sklar.
Ecological Modelling, Vol. 27, No. 1/2, p 45- March, 1985. 2 Fig, 4 Tab, 65 Ref.

Descriptors: *Model studies, *Wetlands, *Eff tiveness, *Optimization, *Mathematical mod Articulation, Accuracy.

Eighty seven mathematical models of freshwa wetlands and shallow water bodies were classif by wetland type, location, and degree of nonline ity, and rated by three new indices: articulati accuracy; and effectiveness. Articulation measu the size and complexity of the model in the th modes of components, space, and time. Accur combines measures of goodness-of-fit in e mode. Effectiveness measures explanatory pov as a combination of articulation and accuracy. curacy fell in the models investigated with incre ing articulation. This may be a result of increas complexity and cost. The maximum effectiven was achieved at intermediate articulation. Eff tiveness fell with highly accurate models indicat that such models tend to be low in articulat while highly articulate models tend to be low accuracy. Such ranking of models may provid useful guide to model builders who are concern with maximizing the effectiveness of their moc and making use of limited resources. (Baker-I W86-00433

PHOSPHORUS AND NITROGEN EXCRETI BY LAKE ZOOPLANKTON (ROTIFERS A CRUSTACEANS) IN RELATIONSHIP TO IN VIDUAL BODY WEIGHTS OF THE ANIMA AMBIENT TEMPERATURE AND PRESEN OR ABSENCE OF FOOD,
Polish Academy of Sciences, Lomianki. Inst. Ecology.
J. Ejsmont-Karabin.
Ekologia Polska, Vol. 32, No. 1, p 3-42, 1984. Fig, 3 Tab, 66 Ref.

Descriptors: *Phosphorus, *Nitrogen, *Zoopla ton, *Lakes, Temperature effects, Cladocera, pepoda, Rotatoria, Excretion, Nutrients, Food.

The relationship has been determined between specific rate of P and N excretion by plank rotifers and crustaceans, and ambient temperat and individual body weights. The rate of excret is strongly dependent on the temperature, this r tionship being of exponential nature. Over the t perature range 10-35 C the Q-10 for the rate phosphorus excretion was 2.6, for nitrogen -2.4 power relationship has also been demonstrated tween the rate of excretion of both the eleme studied and the individual body weight of anim representing three taxonomic groups: rotato cladocera and copepoda. A greater decrease - lowing an increase in animal body weight - in rate of the excretion of phosphorus than of ni gen causes an increase in the N:P ratio in excret products following a growth of body weight. S vation of animals prior to measurement cause decrease in the excretion rate: 1.9 fold in the of P and 2.2 fold in the case of N. Using the res of this study and some literature data it was po ble to build equations describing the effect of b weight and temperature on the rate of P-I excretion. (Baker-IVI)
W86-00435

BIOMASS OF MACROPHYTES IN T CHANNEL RUNNING THROUGH AGRIC TURAL AREAS,

h Academy of Sciences, Poznan. Dept. of
biology and Forestry.
oldyn.
ogia Polska, Vol. 32, No. 1, p 167-176, 1984. 1
5 Tab, 15 Ref.

riptors: *Macrophytes, *Channels, *Biomass,
nd, Drainage channels, Aquatic plants, Vege-
n, Seasonal variation.

results of investigations on the biomass of
ophytes conducted in the vegetation season in
in the channel running out from a lake and
ing the water from meadows and fields near
w, Poland are reported. Sparganium simplex
Elodea canadensis were dominant species of
lar plants. The biomass was estimated once a
h between June and September for S. simplex,
etween June and October for E. canadensis.
maximal biomass of above ground parts of S.
ex was recorded in August, whereas the total
ss of underground parts of this species in-
ed during the whole period of investigations.
iomass of E. canadensis increased during the
ation season till it attained the maximum in
mber. The mean biomass of S. simplex during
naximal growth of aboveground parts was
g dry wt/sq m, whereas the highest one was
g dry wt/sq m, and the biomass of under-
d parts was 40% of total biomass. The mean
ss of E. canadensis was 49.4 g dry wt/sq m,
as the maximal biomass was 426 g dry wt/sq
e biomass of underground parts was 2.3% of
iomass. The total biomass of all macrophytes
ing in the channel, on the average, in plant
es, was 82.02 g dry wt/sq m, whereas on the
length of the channel part examined includ-
e areas not colonized by vascular plants, it
0.25 g dry wt/sq m. The biomass of under-
d parts was 16.3% of total biomass. The
ity, that is 83.9% of biomass, of underground
was produced by S. simplex. (Baker-IVI)
00436

**ORS INFLUENCING INORGANIC TUR-
TY IN A GREAT PLAINS RESERVOIR,**
oma State Univ., Stillwater. Dept. of Zoolo-

Nolen, J. Wilhm, and G. Howick.
biologia, Vol. 123, No. 2, p 109-117, April,
4 Fig, 2 Tab, 38 Ref.

iptors: *Reservoirs, *Lake Carl Blackwell,
homa, *Turbidity, *Opacity, Secchi disc,
, Runoff, Sedimentation, Wind, Rainfall,
l studies, Sediments, Water depth.

elometric and Secchi disc turbidities were
red at 16 sampling sites at Lake Carl Black-
Oklahoma on 54 dates from 12 February 1982
January 1983. Measurements of precipitation,
velocity, effective fetch, water depth, and
ent particle size were also recorded. Turbidi-
ues ranged from 16 to 1140 NTU and Secchi
ansparency from 2 to 110 cm. Large fluctua-
in nephelometric turbidity in upper reaches
early summer resulted from sediment inputs
unoff following heavy May rains. Horizontal
nts of turbidity change during runoff can be
ted to the rapid settling of coarse-grain sus-
d materials prior to transport to deep-water
s. While sediment inputs from runoff result-
large turbidity increases during the study,
is probably less important in the regulation
bidity on a long-term basis. Under extremely
conditions, drastic increases in nephelome-
rbidity resulted in only minimal changes in
disc transparency. Multiple regression
s relating nephelometric turbidity to meas-
limatological and morphometric parameters
reservoir were constructed. A single easily-
red variable that integrated important pa-
rs influencing sediment resuspension was
eveloped. Resuspension is primarily a func-
f wave height and water depth. Cumulative
of rainfall for 1 to 5 days preceeding sam-
were correlated with turbidity. A much more
and practical turbidity model was construct-
ing data collected prior to heavy rains.
-IVI)
0440

**RELATIONSHIPS BETWEEN ZOOPLANK-
TON ABUNDANCE AND TROPHIC STATE IN
SEVEN NEW ZEALAND LAKES,**
Waikato Univ., Hamilton (New Zealand). School
of Science.
M. A. Chapman, J. D. Green, and V. H. Jolly.
Hydrobiologia, Vol. 123, No. 2, p 119-136, April,
1985. 11 Fig, 12 Tab, 49 Ref.

Descriptors: *Zooplankton, *Lakes, *Rotorua,
*New Zealand, Trophic level, Population dynam-
ics, Copepods, Cladocera, Crustaceans, Population
dynamics.

Zooplankton communities were studied in 1977-78 in lakes of different trophic status in Rotorua, New Zealand. In six of the seven study lakes, the zooplankton was usually dominated by calanoid copepods but even in Lake Tikitapu calanoids were of similar abundance to cladocerans. Such a predominance of calanoid copepods is typical of many New Zealand lakes though cladocerans may be seasonally more abundant in some cases. There does not seem to be a clear-cut relationship between trophic status and the type of community. Despite the similarities in species composition in the study lakes they clearly differed in the abundance of zooplankton with the greatest contrasts between Lakes Okaro and Ngapouri, where numbers were generally highest, and Lake Tikitapu in which populations were very much smaller. Certain features were common to all. Population sizes varied during the year by less than an order of magnitude in contrast to fluctuations over two or three orders in perennial species in northern hemisphere temperature lakes. The fluctuations that did occur varied between the lakes with no common pattern. A third feature was the continuously low clutch sizes and often low percentages of breeding females found in all the crustacean species. In both the cluster analyses and the principal component analysis the differences between the lakes were most marked in the warmer months particularly when the volumetric data were tested. The greater sensitivity of these data presumably reflects the importance of nutrient dilution in relation to plankton productivity. The use of zooplankton as integrators of biological conditions avoids the problems of interpreting data influenced by morphometric features of lakes such as hypolimnetic oxygen deficits or macrobenthos standing crops, while the long generation times of copepods in particular enable less frequent sampling than is required for phytoplankton. (Baker-IVI)
W86-00441

**SPRING BENTHIC MACROINVERTEBRATE
COMMUNITIES OF SELECTED STREAMS IN
THE HIGH CAUCASUS (AZERBAIJAN SSR),**
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
A. Kownacki.
Hydrobiologia, Vol. 123, No. 2, p 137-144, April, 1985. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Invertebrates, *Streams, *Caucasus, *Azerbaijan SSR, *USSR, Population dynamics, Fauna, Aquatic insects.

Invertebrates were collected at fifteen sites in streams of the Caucasus (Azerbaijan SSR) in March of 1970: 75 taxa of invertebrates were found. The most numerous group, as far as number of taxa and abundance of specimens are concerned, was Chironomidae. Usually their quantity exceeded 50% of the total abundance of invertebrate fauna and at some sites, even 90%. Ephemeroptera, Plecoptera, and Simuliidae were the other important components of the fauna. The total abundance of the fauna differed greatly at particular sites. Least abundance was recorded in the stream Kishchay and its tributary Domarchynchay. Greatest abundance was found in a nameless tributary of the stream Dagirmanchay. The total abundance of the fauna usually varied at particular sites from 300 to 900 specimens. Four community groups were distinguished. It was determined that spring time in high mountain streams and rivers was more conducive to the development of the invertebrate fauna. (Baker-IVI)
W86-00442

**CHARACTERIZATION OF BENTHIC MICRO-
HABITAT; AN EXPERIMENTAL SYSTEM FOR
AQUATIC INSECTS,**
Illinois Univ. at Urbana-Champaign. Dept. of Urban and Regional Planning.
L. L. Osborne, E. E. Herricks, and V. Alavian.
Hydrobiologia, Vol. 123, No. 2, p 153-160, April, 1985. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Benthos, *Microhabitats, *Aquatic insects, Insects, Population dynamics, Thermistors, Flow velocity, Streams, Channels, Benthic environment, Habitats.

An experimental system used to determine microhabitat current velocity and microhabitat selection by aquatic insects is described. The system includes a microvelocity probe and a hydraulically calibrated artificial substrate. A thermistor velocity probe detects flow velocities to 0.5 m/sec near the surface of substrates at locations inhabited by aquatic insects. The artificial substrate was designed to provide two major habitat types, highly turbulent vortex areas and region with unidirectional, near laminar flow. Substrate calibration and microhabitat characteristics of the substrates are demonstrated. Experimental studies of Simulium sp. location on substrates indicated that while simuliid larvae are characteristic of lotic, erosional habitats, actual microhabitats selected are governed by substantially lower flow velocity. One major advantage of the system is that once a substrate configuration is hydraulically analyzed and calibrated, the calibration will not change. Standard substrates can be used in a number of field situations providing similar information for a number of taxa. The system also permits determination of microhabitat velocity with minimal disturbance to the organism. Experimental studies of aquatic insect behavior, evaluations of competition, and general descriptions of life history and environmental relationships may all be enhanced through the use of such a system. Critical microhabitat variable(s) can be kept constant allowing careful evaluation of the effects of either chemical or biological modification of environmental conditions on aquatic insects. (Baker-IVI)
W86-00443

**REACTION OF LARVAE OF SIMULIUM
NOELLERI (DIPTERA) TO DIFFERENT CUR-
RENT VELOCITIES,**
London Univ. (England). Dept. of Biological Sciences.
R. S. Wotton.
Hydrobiologia, Vol. 123, No. 3, p 215-218, 1985. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Water currents, *Behavior, *Aquatic insects, Blackflies, Larvae, Velocity, Animal behavior, Insect behavior.

Experiments were conducted to determine whether larvae of different sizes of Simulium noelleri reacted differently to a range of current velocities, using the extent of upstream movement by looping as an indication of differences. As current velocity decreased, a significantly higher percentage of larvae moved more than 50 cm upstream in the course of 90 minutes. In studying the size of larvae which moved more than 10 cm upstream from where they had been placed, overall length measurements were grouped into categories and the percentage of the total number of larvae within each size category which moved more than 10 cm upstream after at least 90 min, had elapsed was plotted against current velocity. The larger a larva becomes the more likely it is to move upstream in lower water velocities, or, conversely, smaller larvae have a greater tolerance of low velocities. Concerning the distance travelled by larvae per unit time, the maximum speed of upstream migration was recorded in four of the experiments when, in each case, one larva moved 40 cm upstream at a rate of .067 cm/sec. Speeds of over .06 cm/s were commonly recorded in the first ten minutes of experiments. (Baker-IVI)
W86-00445

EFFECTS OF METAL SPECIATION ON GROWTH OF PHYTOPLANKTON WITH SPECIAL REFERENCE TO IRON,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
For primary bibliographic entry see Field 5C.
W86-00455

SURVEY OF THE DISTRIBUTION OF CHIRONOMIDAE (DIPTERA, INSECTA) OF THE RIVER RHINE BY SAMPLING PUPAL EXUVIAE,
Bristol Univ. (England). Dept. of Zoology.
R. S. Wilson, and S. E. Wilson.
Hydrobiological Bulletin, Vol. 18, No. 2, p 119-132, December, 1984. 4 Fig, 4 Tab, 36 Ref, 1 Append.

Descriptors: *Rhine River, *Midges, *Distribution, Europe, Aquatic insects, Population dynamics, Water pollution effects, Species composition, Ecological distribution, Sediments.

The Rhine rises in the Swiss Alps and discharges to the North Sea. In 1981, the Rhine was sampled for chironomid pupal exuviae. The Grande Canal d'Alsace and selected tributaries were also sampled. In the 78 samples taken, 9771 exuviae were examined and 135 taxa identified. A species list shows the distribution of taxa between the principal regions of the river. Above the Bodensee the Rhine has a diverse fauna dominated by Orthocladiinae. The Hochrhein near the entry of the River Aare, and the River Aare itself, also have a diverse fauna, but include many sediment dwelling Chironominae. Below Strasbourg the fauna changes markedly, losing most of its sediment dwellers, and shows a great increase of pollution tolerant strains. The fauna generally becomes less diverse and of poorer quality throughout the Oberrhein sections, and faunal changes are related to the inflow of the Rivers Neckar and Main. Samples from the Mittelrheingorge and the Niederrhein are generally dominated by two species of Rheotanytarsus and show a progressive reduction of diversity coupled to an increase of pollution tolerant species. The low proportions of sediment dwellers in the Niederrhein and the Waal, suggests that the sediments are unsuitable for the support of a normal chironomid fauna, possibly through the accumulation of toxic materials. (Baker-IVI)
W86-00457

LONGITUDINAL DISTRIBUTION OF MACROINVERTEBRATES AND FISH IN A LOWER NIGER DELTA RIVER (RIVER SOMBREIRO) IN NIGERIA,
Port Harcourt Univ. (Nigeria). Dept. of Zoology.
C. S. Nwadiaro.
Hydrobiological Bulletin, Vol. 18, No. 2, p 133-140, December, 1984. 1 Fig, 3 Tab, 23 Ref.

Descriptors: *Macroinvertebrates, *Fish, *Niger River, *Sombreiro River, *Nigeria, *Spatial distribution, Distribution patterns, Streams, Rivers, Aquatic insects, Crustaceans, Mollusks, Annelids, Arachnids, Water chemistry.

Samples were taken monthly from November 1979 to June 1982 at six stations located along the River Sombreiro, Nigeria. The macroinvertebrate community was dominated by Crustacea and Insecta, followed by mollusks, annelids and arachnids. Their respective contributions to the taxonomic composition of the river were 36%, 34%, 15%, 9%, and 6%. The Crustacea were virtually restricted to the downstream brackish water stations where they were very abundant and taxonomically more diverse. The mollusks were found exclusively in the lower and alkaline zone of the river. The location of the fish and division by species further confirms the roughly divided two zones of the river with the physicochemical, macroinvertebrate and ichthyofaunal boundaries located between Lat. 4 degrees 55 minutes and 4 degrees 48 minutes N and Long. 6 degrees 42 min and 6 degrees 47 min E. The upper zone has insects, oligochaetes and arachinids as the dominant invertebrate fauna and the dwarf cichlids as its diagnostic fish species. The lower zone has Crustacea and Mollusca as the cardinal invertebrate fauna and the monodactylid Monodactylus sebae as its distinctive fish type. The dominating factors in the zonation of the river into two zones are mainly chemical (salinity, alkalinity, total hardness) and to a much less extent physical (current velocity and the associated substrate composition). (Baker-IVI)
W86-00458

USE OF DIALYSIS CELLS FOR INVESTIGATING PORE WATER COMPOSITION IN WETLAND SUBSTRATA, WITH PARTICULAR REFERENCE TO DISSOLVED IRON AND SULPHIDE,
Sheffield Univ. (England). Dept. of Botany.
B. D. Wheeler, and K. E. Giller.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 6, p 707-716, June, 1984. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Dialysis cells, *Sampling, *Interstitial water, *Wetlands, Iron, Sulfides, Peat, Anaerobic conditions, Substrate.

A dialysis method is described for sampling pore water from depth in wetland substrata (peats). The method is designed particularly to permit collection of large sample volumes (50-150 ml free from colloidal or particulate material while minimizing changes in concentrations of dissolved ions as a result of sampling. The method is based upon the burial and subsequent retrieval (after equilibration) of cells made from dialysis membrane filled with deionized water. Field investigations of concentrations of dissolved iron and sulfide in the pore water of base-rich mires were made using this method. The dialysis cell method is simple and cheap. The filled cells are surprisingly robust and amenable to handling in field conditions. It seems probable that the method could be of considerable value in investigating pore water composition in anaerobic wetland substrata. (Moore-IVI)
W86-00511

PHOTOSYNTHESIS AND PRIMARY PRODUCTION OF MICROCYSTIS AERUGINOSA KUTZ. IN LAKE KASUMIGAURA,
National Inst. for Environmental Studies, Tsukuba (Japan). Environmental Biology Div.
N. Takamura, T. Iwakuma, and M. Yasuno.
Journal of Plankton Research, Vol. 7, No. 3, p 303-312, 1985. 4 Fig, 1 Tab, 28 Ref.

Descriptors: *Photosynthesis, *Primary productivity, *Microcystis, *Lake Kasumigaura, *Japan, Solar radiation, Water temperature, Cyanophyta, Algae.

Seasonal changes in the photosynthesis and primary production of Microcystis aeruginosa Kutz. were investigated in Lake Kasumigaura (Japan) during 1981-1982. Microcystis always showed a light-saturated photosynthesis-light curve. Both Pmax and the initial slope of the photosynthesis-light curve of Microcystis in early summer were very high, so it was concluded that Microcystis utilized both low and high intensities efficiently. The Pmax of Microcystis was found to be a function of the water temperature except in August and September. The linear regression on the temperature-Pmax relationship discontinued at 11 C, where the Pmax value dropped; Microcystis did not photosynthesize below 4 C. The initial slope of the curve was also descending below 11 C. It is suggested that Microcystis changes its physiological properties below 11 C. The highest value of gross production calculated for M. aeruginosa was 5.4 gC/sq m/d in July; the annual gross production was estimated to be 300 gC/sq m/year (i.e., 40% of the total primary production in this lake). (Author's abstract)
W86-00518

LIMNOLOGICAL STUDIES OF WATERFOWL HABITAT IN SOUTH-WESTERN NEW SOUTH WALES. I. WATER CHEMISTRY,
Commonwealth Scientific and Industrial Research Organization, Lyneham (Australia). Div. of Wildlife and Rangelands Research.
S. V. Briggs, M. T. Maher, and S. M. Carpenter.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 59-67, 1985. 2 Fig, 2 ... 30 Ref.

Descriptors: *Limnology, *Water chemi... *New South Wales, Lake Merrimajeel, *Mur... bidgil Swamp, Hydrogen ion concentration, ... lands, Water level, Dissolved oxygen, Sodium, ... tassium, Calcium, Chlorides, Nitrates, Phosph...

Field investigations were undertaken at two ... lands near Booligal in southwestern New S... Wales, which are typical of many in inland s... eastern Australia. Murrumbidgil Swamp is ... proximately circular with a diameter of 1000 ... is dominated by river red gum and support ... variety of submerged and floating vegetation. ... Merrimajeel is an elliptical depression, app... mately 750 m by 1500 m, with scattered shrul... lignum and a dense submerged aquatic vegeta... Lake Merrimajeel is filled via a natural chr... from Murrumbidgil Swamp. Water chemistr... the two impermanent wetlands was studied as ... of a larger investigation into the relationshi... tween water level rises and waterfowl breedi... such wetlands. Except for pH and oxygen, ... wetlands were chemically similar, as woul... expected because they are connected. Sodium ... tassium, calcium and chloride concentrations, ... ductivity and pH were inversely related to ... level. Total loads of iron, phosphate, nitrate ... sulfate increased as the wetlands flooded d... wetting phases. Nitrate and phosphate leve... experimental tanks also peaked after flooding. ... high nutrient levels in freshly flooded wet... and tanks suggest that release of nutrients fro... soil following reflooding occurred in Murrun... gil Swamp and Lake Merrimajeel. (Moore-...
W86-00522

PHYTOPLANKTON OF THE LA TR... RIVER, VICTORIA,
Latrobe Valley Water and Sewage Board, Tr... gon (Australia).
B. C. Chessman.
Australian Journal of Marine and Freshwate... search, Vol. 36, No. 1, p 115-22, 1985. 3 Fig, 1 ... 18 Ref.

Descriptors: *Phytoplankton, *La Trobe R... *Victoria, Chlorophyll a, Algae, Diatoms, Sp... distribution, Lake Narracan, Eutrophication, ... sonal variation, Flow discharge.

The La Trobe River is one of the largest str... of southeastern Victoria, rising about 75 km e... Melbourne and flowing to Lake Wellington, ... western extremeity of the Gippsland Lakes. Pl... plankton was sampled on a monthly basis ... year at five stations on the La Trobe River. I... upper, mostly forested, reaches of the river, ... rophyll a concentrations and cell densities ... uniformly very low, and the dominant algae ... detached benthic diatoms and flagellated sp... In the plains section of the river, downstream ... impoundment (Lake Narracan), spring and au... blooms occurred, with a marked reductio... abundance in midsummer and midwinter. ... true phytoplankters were observed only in ... Narracan and stations downstream. The lo... planktonic flora was dominanted by centric... toms, particularly Melosira distans in autumn ... Skeletonema potamos in spring. Attempts to ... the seasonal changes in phytoplankton popul... of the lower La Trobe the hydrographic, tem... ture, and nutrient concentration data from ri... river monitoring were not entirely successful ... marked increase in populations in October ... decline in June did coincide closely with a re... tive decrease and increase in river dischar... these times. (Moore-IVI)
W86-00523

IN SITU MEASUREMENTS OF UPTAKE... INORGANIC CARBON AND NITROGEN... THE AQUATIC LIVERWORTS JUNGERM... NIA VULCANICOLA STEPH. AND SCAP... UNDULATA (L.) DUM. IN AN ACID STRE... KASHIRANASHIGAWA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological ... ences.

. Miyazaki, and K. Satake.
ydrobiologia, Vol. 124, No. 1, p 29-34, May, 985. 5 Tab, 27 Ref.

escriptors: *Liverworts, *Carbon, *Nitrogen, Acid streams, *Kashiranashigawa, *Japan, Aquat- plants, Solar radiation, Nitrates, Ammonium, utrients.

situ uptake of inorganic carbon and nitrogen by e aquatic liverworts Jungermannia vulcanicola eph. and Scapania undulata (L.) Dum. was meas- ed in an acid stream, Kashiranashigawa, Japan. ie uptake activities were similar in the both ecies. The activities were highest at the tip of oots, and decreased gradually towards the base. rbon uptake at the tip in the light was 0.00104 r J. vulcanicola and 0.00082 g C/g dry wt/h for undulata. Ammonium was effectively incorpo- ed into the shoots, and the uptake activity at the was between 0.000019 and 0.000058 g N/g dry /h. Nitrate uptake was smaller than ammonium take. The ratio of dark to light uptake in ammo- m uptake experiments was larger than that in rbon uptake experiments. These results suggest t the liverworts use ammonium as a major nitro- n source, and that ammonium uptake was less pendent on light than carbon uptake. (Author's stract)
86-00529

NDSAT STUDY OF THE AQUATIC VEGE- TION OF THE LAKE LUODONJARVI RES- VOIR, WESTERN FINLAND,
lu Univ. (Finland). Dept. of Astronomy.
Raitala, and J. Lampinen.
uatic Botany, Vol. 21, No. 4, p 325-346, April, 5. 5 Fig, 2 Tab, 20 Ref.

scriptors: *Satellite technology, *Aquatic nts, *Lake Luodonjarvi, *Finland, Remote sens- , Reservoirs, Mapping, Spectral reflectance.

ke Luodonjarvi (Finland) is situated on the Gulf Bothnia coast and was formed by the damming what was formerly a brackish-water sea-bay in 2. The lake area has been effectively over- wn in places. The Loudonjarvi and Ojanjarvi en water areas were studied using Landsat MSS agery which consists of 4 spectral bands and ws different surface units with characteristic ctral reflectances to be identified down to the imum resolution (0.5 ha). Spectral differences re detected between different water areas. Sev- een aquatic complexes or types were classified arately on the basis of changes in water charac- stics and depth, bottom quality and vegetational cession. The vegetation in summer 1983 was orded in this way and reviewed against previ- mappings in order to illustrate the multitem- al aspects of Landsat studies. The analysis of ndsat MSS data values and associated ground ification data provides a useful map of the ent and location of the overgrown portion of lake and environmental changes within the a, and can be used to predict the direction of cession trends which are controlled by local ditions. (Moore-IVI)
6-00532

CORDING ECHO SOUNDER FOR ASSESS- G SUBMERGED AQUATIC PLANT POPU- TIONS IN SHALLOW LAKES,
ricultural and Food Research Council, Oxford gland). Weed Research Organization.
primary bibliographic entry see Field 7B.
6-00533

ESHWATER NAIAD (MUSSEL) FAUNA OF E NOLIN RIVER IN THE GREEN RIVER AINAGE OF CENTRAL KENTUCKY (MOL- SCA: BIVALVIA),
rshall Univ., Huntington, WV. Dept. of Biolog- Sciences.
W. Taylor.
tilus, Vol. 97, No. 3, p 109-112, July, 1983. 4

scriptors: *Mussels, *Nolin River, *Kentucky, ms, Endangered species, Distribution, Green er Drainage.

A survey of the freshwater mussels (naiads) of Nolin River of the Green River, Kentucky, drainage, produced specimens of twenty-one species of naiads, and the Asian Clam, Corbicula fluminea. Six of the species reported from the Nolin are considered Endangered or of Special Concern by the Kentucky Academy of Science. Villosa ortmanni is considered endangered by most malacologists because it is restricted in distribution to the Green River drainage. At present, however, it is the most commonly found species in the Nolin River. (Author's abstract)
W86-00534

UNIONIDS (BIVALVIA) OF LOCH RAVEN RESERVOIR, MARYLAND,
P.O. Box 144878 Coral Gables, FL 33114.
G. A. Long.
Nautilus, Vol. 97, No. 3, p 114-116, July, 1983. 1 Fig.

Descriptors: *Mussels, *Loch Raven Reservoir, *Maryland, Water levels, Water currents, Distribution, Behavior.

A 6-yr informal study of mussels in Loch Raven Reservoir, Maryland (USA), yielded 600 specimens, all of which belonged to three species: Anodonta cataracta Say 1817, Lampsilis radiata radiata (Gmelin 1791), and A. imbecillis Say 1982. Four sites were collected: (1) Deadman's Cove, the main channel of Gunpowder Falls, south of Dulaney Valley Road bridge, east of Warren Bridge, and at the Fishing Center. A. cataracta cataracta represented 75% of the shells collected, and was found in quantity at all sites. L. radiata radiata specimens were second in abundance, and A. imbecillis was third, being found at two sites in a growth series that suggested a viable, self-sustaining population. Ninety percent of the specimens of all the taxa collected were dead, having recently expired due to receding water levels. The two species of Anodonta were very active in the substrate, particularly as water levels were reduced, and their directions of movement suggested that as water levels reached less than 0.5 m, the animals were deliberately seeking deeper water. All Lampsilis specimens were found on a substrate normally submerged under deeper water than that in which the bulk of the Anodonta specimens were found (no less than 2 m). All Lampsilis specimens were found at the edge of the swiftest available current in the collection area. Overall, more than 60% of the Lampsilis specimens were found at the Dulaney Valley Road bridge site, where the current is the strongest and most consistent of the entire impoundment. (Rochester-IVI)
W86-00535

LIMNOLOGICAL STUDIES OF RASHDIYAH RESERVOIR, BAGHDAD, IRAQ,
Biological Research Center, Baghdad (Iraq). Dept. of Zoological Sciences.
A. N. Khalaf, A. K. M. S. Islam, M. S. Mohammed, and A. R. Al-Jafery.
Journal of Biological Sciences, Vol. 14, No. 1, p 25-45, 1983. 9 Fig, 9 Ref.

Descriptors: *Limnology, *Rashdiyah Reservoir, *Iraq, Reservoirs, Water temperature, Solar radiation, Rainfall, Dissolved oxygen, Carbon dioxide, Alkalinity, Salinity, Calcium, Magnesium, Sulfates, Bicarbonates, Phytoplankton.

The physical, chemical and biological conditions of Rashdiyah reservoir (Iraq) were investigated between December, 1979 and November, 1980. Water temperature varied between the depths of a station as well as among the stations on a given sampling date. Duration of sunshine was highest in August and lowest in January and February. Relative humidity was highest in December, January and February and lowest in September. Average rainfall was the highest in February and there was no rainfall at all from May to October. Dissolved oxygen was highest in January and lowest in August. Free carbon dioxide was highest in July and lowest in January. The water of the reservoir were slightly alkaline throughout the period of study. The periods of higher temperatures were accompanied by higher concentrations of salinity. Calcium and magnesium among the cations and sulfate and bicarbonate among the anions dominated during the investigation. The nutrients under consideration showed two peaks one in March and a second one in November. Phytoplankton population showed two maxima one in March and a second one in November. Attempts were also made to correlate the influence of the physicochemical factors upon the growing condition of phytoplankton in the reservoir. (Author's abstract)
W86-00536

CONTRIBUTION TO THE APPLICATION OF THE REGRESSION ANALYSIS IN CONNECTION WITH THE ESTIMATION OF THE PRIMARY PRODUCTION IN THE GROSSER MUGGELSEE (BERLIN) FOR THE PERIOD OF 1979-1982 (EIN BEITRAG ZUR ANWENDUNG DER REGRESSIONSANALYSE IM ZUSAMMENHANG MIT DER SCHATZUNG DER PRIMARPRODUKTION IM GROSSEN MUGGELSEE (BERLIN) FUR DEN ZEITRAUM 1979...1982),
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
R. Stellmacher, and B. Nixdorf.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 653-657, 1984. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Muggelsee, *Germany (Democratic Republic), *Primary productivity, Regression analysis, Water quality, Statistical methods, Mathematical studies.

The lake Muggelsee (German Democratic Republic), which is important for the drinking water supply of Berlin, has been thoroughly investigated for some years with respect to its quality state and conversion of substances. To reduce working time and material expense for measuring of the primary production, various mathematical-statistical possibilities are checked with the aid of the results of series of investigations which have been performed for years. Of the calculating methods studied, the linear regression through the origin and the exponential approach provided the best approximation of measured and calculated results of the surface integral of the primary production as estimated from the production value of the optimum horizon for the Muggelsee type of lake. (Author's abstract)
W86-00551

VARIATION OF CHEMICAL PARAMETERS IN THE DEPTH PROFILE OF THE RIVER CHAMPANALA,
S.M. Coll., Bhagalpur (India). Dept. of Zoology.
R. Hasan.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 679-683, 1984. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Champanala, *India, *Chemical properties, *Water depth, Stratification, Velocity, Flow discharge, River flow, Water temperature, Alkalinity, Dissolved oxygen, Carbon dioxide, Hydrogen ion concentration.

The River Champanala (India), which derives its flow from the Ganges during flood, and reenters the Ganges after about 20 km, exhibited a temporary chemocline in late October, 1978, when sampling of a profile at about 0.5 km upstream from its confluence with the Ganges was conducted. At that time, the mean velocity of flow was 2.75 m/sec, and the discharge was 546 cu m/sec (based on linear interpolation from sampling done at other times); the depth of the river at the time of sampling was 1.68 m. Temperature declined gradually from the surface (29.0 C) to 0.76 m (28.0 C), and then declined to 27.8 C at 1.37 m, being the same at the bottom. Carbonate alkalinity was nil throughout the profile, CaCO3 was 148.0 ppm throughout the profile, dissolved oxygen declined from 9.5 ppm at the surface to 9.3 ppm at 0.76 m, and then to 6.4 ppm at the bottom. Free carbon dioxide was 2.2 ppm at the surface, 4.5 ppm at 0.76 m, and 1.8 ppm at 1.07 m, and only 1.5 ppm at the bottom. pH was 8.0 from the surface to 0.76 m, declining to 7.6 at the bottom. High photosynthetic activities probably account for the dissolved oxygen profile, whereas the C02 profile may be accounted for by

the shallow depth of flow and comparatively high velocity of flow, as well as high respiration. (Rochester-IVI)
W86-00552

STUDIES ON RIVERINE ECOLOGY OF TORRENTIAL WATERS IN THE UPLANDS OF THE GARHWAL REGION, II. SEASONAL FLUCTUATIONS IN DIATOM DENSITY,
Garhwal Univ., Srinagar (India). Dept. of Zoology.
P. Nautiyal.
Proceedings of the Indian Academy of Sciences (Animal Sciences), Vol. 93, No. 7, p 671-674, December, 1984. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Diatoms, *Seasonal variation, *Streams, *Garhwal, *India, Alaknanda, Nayar, Water temperature, Silt, Monsoons, Water currents.

Seasonal fluctuations along with certain physicochemical parameters were recorded for two hill-streams, the Alaknanda (snow-fed) and the Nayar (spring-fed) in the Garhwal Region (India), In the former, the water temperature range of 9-14 C is considered optimum for the growth of diatoms, compared to 12-21 C in the Nayar. In both hill-streams diatoms achieved their maxima during January, when the water temperature is the lowest. Sudden influx of rain water carrying enormous silt during monsoon is responsible for the decline in density. The water temperature and current, especially the latter is thus a detrimental factor. The interesting feature of the study is, the relatively higher percentage of diatoms in the Nayar than in the Alaknanda, obviously to be attributed to the warm waters in the former. (Author's abstract)
W86-00576

SEASONAL VARIATION IN PRIMARY PRODUCTION IN RELATION TO SOME LIMNOLOGICAL FEATURES IN LAKHOTIA LAKE (INDIA),
Jodhpur Univ. (India). Dept. of Zoology.
T. C. Khatri.
Proceedings of the Indian Academy of Sciences (Animal Sciences), Vol. 93, No. 7, p 697-702, December, 1984. 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Limnology, *Primary productivity, *Lakhotia, *India, Lakes, Seasonal variation, Chlorophyll a, Water temperature, Alkalinity, Monsoons.

Lakhotia is a man-made, rain-fed, perennial lake in Pali city, in the semiarid region of Rajasthan, India. The primary production of the lake was determined and compared with other tropical and temperate water bodies. The annual gross production in Lakhotia was 1956.035 gC/sq m. The maximum gross primary production was recorded during summer when there was an increase in water temperature, chlorophyll-a and alkalinity. After attaining a peak in June, the alkalinity declined sharply during monsoon and consequent flood, and in winter it increased again. High production was observed when temperatures ranged from 27-33 C. The difference between gross and net primary production was wide, the percentage of respiration in gross production being 15.6-100. Primary production in Lakhotia is moderate. Chlorophyll-a and water temperature act as favorable factors, whereas transparency and alkalinity are limiting factors. (Moore-IVI)
W86-00578

PROBABILITY-OF-USE FOR DEPTH, VELOCITY, AND SUBSTRATE BY SUBYEARLING COHO SALMON AND STEELHEAD IN LAKE ONTARIO TRIBUTARY STREAMS,
New York State Dept. of Environmental Conservation, Albany. Bureau of Environmental Protection.
J. D. Sheppard, and J. H. Johnson.
North American Journal of Fisheries Management, Vol. 5, No. 2B, p 277-282, Spring, 1985. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Salmon, *Water depth, *Velocity, *Substrates, *Streams, New York, Lake Ontario tributaries, Coho, Steelhead, Habitats, Streamflow, Seasonal variation.

Probability-of-use information for depth, velocity, and substrate by subyearling coho salmon (Oncorhynchus kisutch) and steelhead (Salmo gairdneri) in three New York tributaries of Lake Ontario was obtained during June and October in 1980. In June, coho salmon occurred predominantly in areas with mean velocities of 0.30-0.70 ft/second and at depths of 2.00-2.40 ft, whereas steelhead occupied habitats with mean velocities of 0.40-0.80 ft/second and depths of 0.30-0.50 ft. In October, subyearling coho salmon were found in areas with mean velocities of 0.00-0.30 ft/second and at depths of 1.50-2.80 ft while steelhead occurred at depths of 0.60-1.20 ft where mean velocities were 0.10-0.80 ft/second. Subyearling coho salmon occurred over gravel-cobble substrates during both seasons, whereas steelhead were found in areas with substrate material of larger sizes in the autumn. Observed seasonal differences in the habitat and flow preferences of both species were completely masked when the data were pooled to yield a single estimate for depth and mean velocity. Variations in the probability-of-use for these habitat parameters may be related to seasonal differences in fish size and the physical characteristics of the streams. (Author's abstract)
W86-00590

WHOLE-LAKE FERTILIZATION EXPERIMENTS IN COASTAL BRITISH COLUMBIA LAKES: EMPIRICAL RELATIONSHIPS BETWEEN NUTRIENT INPUTS AND PHYTOPLANKTON BIOMASS AND PRODUCTION,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
For primary bibliographic entry see Field 5C.
W86-00603

DEPTH DISTRIBUTION AND BIOMASS OF SUBMERSED AQUATIC MACROPHYTE COMMUNITIES IN RELATION TO SECCHI DEPTH,
McGill Univ., Montreal (Quebec). Dept. of Biology.
P. A. Chambers, and J. Kalff.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 701-709, April, 1985. 6 Fig, 5 Tab, 38 Ref.

Descriptors: *Water depth, *Macrophytes, *Biomass, *Opacity, Aquatic plants, Submerged plants, Eutrophication, Solar radiation, Charophytes, Angiosperms, Bryophytes, Water temperature, Lakes, Trophic levels, Nutrients, Wave action, Substrate, Water currents.

Increased nutrient loading into many lakes during the past yr has led to pronounced changes in both the depth distribution and standing crop of submerged aquatic plants. Although changes in the growth of aquatic macrophyte communities are clearly correlated with lake eutrophication, it is not known how much macrophyte biomass will increase or how much the depth of macrophyte colonization will shift in response to changes in lake trophy. Regression models were developed that allow prediction of the maximum depth of macrophyte colonization for angiosperms, bryophytes, and charophytes and the depth of maximum angiosperm biomass from mean summer Secchi depth. Irradiance over the growing season at the maximum depth of colonization was about 1800 L/sq cm (1 cal/sq cm = 0.239 J/sq cm) for angiosperms and bryophytes and 1200 J/sq cm for charophytes. These values represent, on average, 21 and 11% of the photosynthetically available radiation incident on the water surface. Changes in maximum angiosperm biomass were not correlated with Secchi depth. The depth distribution of aquatic macrophyte communities is primarily controlled by irradiance, but environmental parameters other than irradiance and nutrients are also important in determining maximum angiosperm biomass in individual lakes. Such environmental factors include wave action, currents, substrate particle size and stability, and temperature. (Moore-IVI)
W86-00606

POSTSETTLEMENT DIATOM SUCCESS IN THE BAY OF QUINTE, LAKE ONTA
Michigan Univ., Ann Arbor. Great Lakes search Div.
For primary bibliographic entry see Field 5C.
W86-00609

NITROGEN, PHOSPHORUS, AND ORG CARBON CYCLING IN AN ARCTIC LAKE
Alaska Univ., Fairbanks. Inst. of Marine Sc
S. C. Whalen, and J. C. Cornwell.
Canadian Journal of Fisheries and Aquatic ences, Vol. 42, No. 4, p 797-808, April, 1985. 5 Tab, 41 Ref. NSF grants DPP79-0081 DPP77-23475.

Descriptors: *Nitrogen, *Phosphorus, *Or carbon, *Toolik Lake, *Alaska, Cycling nu Arctic lakes, Water temperature, Lake sedi Primary productivity.

Budgets for nitrogen, phosphorus, and o carbon in Toolik Lake, Alaska, were asse from data collected during 1977-81. The total organic carbon (TOC), total nitrogen and total phosphorus (TP) loads to the lake 8557, 290, and 4.64 mmol/sq m. Inlet streams the major source of nutrients to the lake, as precipitation provided only 1, 2, and 5%, r tively, of the annual TOC, TN, TP loads lake. Up to 30% of the annual N and P inp the lake from riverine sources occurred duri first 10 d of stream flow following breakup cold water temperatures and snow-covere limited primary production. Due to the short renewal time (0.5 yr), efficiency of nutrient tion was poor and 90, 82, and 70% of the TOC, TN, and TP inputs to the lake wer charged at the outlet stream. Regeneration the water column supplied 40-66% and 68-7 the N and P necessary for measured primar duction. Yearly accumulation rates for C, N, in the sediment were about 220, 21.0 and mmol/sq m. Phosphorus remineralized with sediment was completely retained due to a tion onto Fe oxide minerals in the oxidizing s layer. Annual rates of release of C and N overlying water column were 110 and 11. mmol/sq m. Mass balance considerations sh no serious errors in estimates of any terms annual sediment and water column N, P, a ganic C budgets. (Author's abstract)
W86-00611

SEDIMENT ACCUMULATION RATES I ALASKAN ARCTIC LAKE USING A M FIED 210PB TECHNIQUE,
Alaska Univ., Fairbanks. Inst. of Marine Sc
J. C. Cornwell.
Canadian Journal of Fisheries and Aquati ences, Vol. 42, No. 4, p 809-814, April, 1985. 1 Tab, 22 Ref. NSF grant DPP77-23475.

Descriptors: *Sediment accumulation, *Le dioisotopes, *Toolik Lake, *Alaska, Arctic Manganese, Iron, Aluminum, Lake sediment

Toolik Lake is located in the northern footh the Brooks Range, Alaska. Its watershed c 65 sq km, while the lake covers 1.5 sq km. Th is ice covered from late September to late Because of high concentrations of authigen and Fe oxides in surficial sediments from Lake, the normalization of depth and Pb-210 ity scales to the sediment Al content was u sediment accumulation rate calculations; resu compared with the conventional Pb-210 technique. The flux of Pb-210 to the lake wa low (10 dpm/sq cm/yr), and excess Pb-210 stricted to the top 5 cm of sediment. The lake sediment accumulation rate is about 2.7 cm/yr and the sediments are little disturb physical or biological processes. Low ra physical and chemical weathering are resp for the low sediment accumulation rates. Th period of runoff, low annual rates of rainfa stabilization of soils by tundra vegetation ra low exports of particulate material to Toolik (Moore-IVI)
W86-00612

TIQUE OF THE INSTREAM FLOW IN-
EMENTAL METHODOLOGY,
iation Management Corp., Drumore, PA.
ldy Run Ecological Lab.
Mathur, W. H. Bason, E. J. Purdy, Jr., and C.
ilver.
adian Journal of Fisheries and Aquatic Sci-
s, Vol. 42, No. 4, p 825-831, April, 1985. 4 Fig,
b, 10 Ref.

criptors: *Instream Flow Incremental Method-
y, *Habitat, *Fish populations, Biomass, Fish
vior, Ecological distribution, Reviews.

view and reanalysis of the published literature
v that several assumptions are violated in the
ication of the Instream Flow Incremental
nodology (IFIM) without consideration of the
ications of so doing. The fundamental assump-
of a positive linear relationship between 'po-
al available habitat' (WUA) and biomass of
has neither been documented nor validated,
cularly in warmwater streams. Absence of
elation precludes prediction of changes in fish
lations. In some studies the test of this as-
ption appears to be equivalent to a calibration
ation. The other assumption violated includes
pendent selection of habitat variables by fish.
presence of significant interaction among habi-
ariables can affect the stream flow recommen-
ns. Another problem exists in application of
ical Habitat Simulation (PHABSIM); one
A unit should not be interpreted as being equal
nother in biological production or habitat value
s shown to be an exact replica. Several combi-
ns of physical variables could give rise to the
amount of WUA, none of which may be
elated to the biomass of fish. The utilization,
bility, or preference curves should not be
ed as probability functions; a rating of 1.0 is
quivalent to probability of 1.0. Care should be
to distinguish between real behavioral pref-
ces of fishes based on distributional occurrence
abundance (relative or absolute size) in a
n. (Author's abstract)
-00613

Water In Plants

LES FOR ESTIMATING DAILY EVAPO-
ION RATES OVER CROPS USING TEM-
ATURE, ELEVATIONAL AND LATITUDI-
DATA ONLY,
ra Research Inst., Pietermaritzburg (South
ca).
lemence.
ort N 5/1982. 45 p, 1 Tab, 2 Append.

riptors: *Evapotranspiration, *Soil water,
vation, *Agricultural hydrology, *Irrigation,
a collections, Natal, South Africa, Altitude,
atic data, Hydrologic data collections, Tem-
ure, Crop factor, Rainfall, Precipitation, Wind
city.

es for estimating evaporation over crops using
cre's method are given for a variety of cli-
s between latitudes of 27-31 degrees south in
h Africa. Factors considered are elevation,
erature statistics, and climate type. Wind
l may be incorporated if known. This is im-
nt in coastal areas. Crop factors (the ratio
een potential evapotranspiration and evapora-
from Class A pans) are given.
-00313

WTH AND WATER USE OF TALL
CUE AS INFLUENCED BY SEVERAL SOIL
ING CYCLES,
inia Polytechnic Inst. and State Univ., Blacks-
Dept. of Agronomy.
King, and L. P. Bush.
nomy Journal, Vol. 77, No. 1, p 1-4, January-
uary, 1985. 5 Fig, 21 Ref.

riptors: *Plant growth, *Water use, *Fescue,
water, Water stress, Watering schedule,
er potential, Osmotic potential, Turgor.

y investigations have studied various physio-
al processes using plants watered on a sched-
ule with the effect of this watering schedule seldom considered significant. An understanding of the effect of watering frequency on growth and water use is required to understand water stress tolerance of tall fescue (Festuca arundinacea Schreb.). Experiments were designed to evaluate the effect of the watering schedule in greenhouse grown tall fescue on growth, water use, and meristem tissue water status. Growth and water use as well as water, osmotic, and turgor potential of the leaf meristematic region were measured on tall fescue seedlings that had been exposed to several Maury soil (a fine, mixed, mesic Typic Paleudalfs) drying cycles (stressed and daily watered). Growth, measured as leaf extension rate (LER), was greater for seedlings watered to field capacity every 4th day than daily watered seedlings when soil of both treatments was allowed to dry. No significant difference in water potential or osmotic potential was observed during the experiment, and the differential LER was not dependent on turgor potential of the meristematic area which was similar to both treatments. Water use was 50 to 100% higher in control seedlings during the first 48 h of a soil drying cycle than in stressed seedlings. After several soil drying cycles the enhanced growth of stressed plants increased as high as 280%, then declined over the next 24 days of daily watering to about 50% above the control. The enhanced LER did not result in greater shoot fresh weights, but, repeated soil drying depressed root development. Consequently, growth, water status, and water use by tall fescue plants during an experiment must be evaluated in terms of the plants prior water stress history. (Author's abstract)
W86-00459

ROW SPACING, PLANT POPULATION, AND WATER MANAGEMENT EFFECTS ON CORN IN THE ATLANTIC COASTAL PLAIN,
Agricultural Research Service, Florence, SC.
For primary bibliographic entry see Field 3F.
W86-00460

PHYSIOLOGICAL RESPONSE OF MEADOWFOAM TO CROP WATER DEFICITS,
Colorado State Univ., Grand Junction. Fruita Research Center.
For primary bibliographic entry see Field 3F.
W86-00461

SOYPHEN: SOYBEAN GROWTH STAGES MODELED FROM TEMPERATURE, DAYLENGTH, AND WATER AVAILABILITY,
Missouri Univ.-Columbia. Dept. of Atmospheric Science.
T. Hodges, and V. French.
Agronomy Journal, Vol. 77, No. 3, p 500-505, May-June, 1985. 6 Fig, 6 Tab, 23 Ref. NOAA grant NA-82-AA-H-00011.

Descriptors: *Soybeans, *Model studies, *Plant growth, *Daylength, *Air temperature, *Water availability, Water stress, Computers, Phenology, Climate, Rainfall.

The soybean plant (Glycine max L.) responds strongly to daylength and temperature in it phasic development. Daylength responses vary greatly between varieties. Under very dry conditions, water stress may also affect development. Attempts to develop physiologically based large area yield models for soybeans have been hampered by the lack of a growth stage model incorporating these responses and applicable to a wide geographic and climatic range. The objective of this work was to develop a physiologically based model to predict growth stage dates for soybeans for the widest possible range of maturity groups and geographic areas. A phenology model was developed and tested for soybean Maturity Groups I to V based on temperature, daylength, and water availability. Coefficients were also developed, but not tested independently for Maturity Groups 00, 0, and VI to IX. Coefficients for Maturity Groups I to V were developed from 3 years (1971 to 1973) of data with five planting dates per year collected at Columbia, MO. The coefficients were tested on data sets taken at the same time at Spickard and Mt. Vernon, MO and on data for the 1981 season from 22 international sites. The test results indicate that the model will generate reliable estimates of soybean growth stages over a wide range of climatic conditions. The coefficients for Maturity Groups 00, 0, and VI to IX were developed from data from international sites, but no data were available for independent testing. The model is available in the FORTRAN and PL/I programming languages. It is suitable for incorporation into a soybean growth simulation model or for running as an independent crop calendar model. The model may be run wherever daily maximum and minimum temperatures and rainfall are available. (Author's abstract)
W86-00462

NITROGEN- AND WATER-USE EFFICIENCY OF SEVERAL COOL-SEASON GRASSES RECEIVING AMMONIUM NITRATE FOR 9 YEARS,
Nebraska Univ.-Lincoln.
J. F. Power.
Agronomy Journal, Vol. 77, No. 2, p 189-192, March-April, 1984. 1 Fig, 7 Tab, 11 Ref.

Descriptors: *Water-use efficiency, *Ammonium nitrate, *Grasses, Fertilizers, Plant growth, Nitrogen, Root growth, Drought, Water use.

Comparative information is needed on differences between grass species regarding dry matter production, root growth, water use, and response to N fertilization, as affected by both age of stand or years of N fertilization. The research reported was conducted on a Temvik silt loam (fine-silty, frigid, mixed Typic Haploboroll) at Mandan, ND. Ammonium nitrate was surface broadcast at 0, 45, or 225 kg N/ha for 9 years on established stands of western wheatgrass (Pascopyrum smithii Rydb.(Love)), crested wheatgrass (Agropyron desertorum (Fish. ex Link) Schult.), intermediate wheatgrass (Elytrigia intermedia (Host) Nevski), smooth bromegrass (Bromus inermis Leyss.), Russian wildrye (Psathyrostachys juncea (Fisch.) Nevski), green needlegrass (Stipa viridula Trin.), and Garrison creeping foxtail (Alopecurus arundinaceus Poir). Dry matter production was usually greatest for E. intermedia. Production for B. inermis, P. smithii, and A. desertorum averaged 85 to 90% that of E. intermedia, and about 65 to 72% for the other species. Dry matter production for all species was generally doubled by 45 kg N/ha, and increased three-to fourfold with 225 kg N/ha. At 45 kg N/ha, N-use efficiency varied from an average of 51 kg dry matter per kg N for E. intermedia to 22 for Ps. juncea. Corresponding values at 225 kg N/ha dropped to 16 and 12 kg/kg N. Root dry weights were generally increased 50 to 100% by both N rates, but consistent differences among species were not evident. Annual water use was increased about 20 mm by fertilization, except in extreme drought years. Water-use efficiency (WUE) was also increased about threefold by fertilization, ranging from 22.6 kg/mm for fertilized E. intermedia to 3.2 for nonfertilized Al. arundinaceus. Water-use efficiency was highly correlated with dry matter production, increasing about 2.8 kg/mm for each 1000 kg/ha increase in production, with no effect of species, time, or N fertilization. (Author's abstract)
W86-00463

RESPONSE OF SELECTED SOYBEAN CULTIVARS TO SOIL MOISTURE DEFICIT,
Missouri Univ.-Columbia.
E. A. Brown, C. E. Caviness, and D. A. Brown.
Agronomy Journal, Vol. 77, No. 2, p 274-278, March-April, 1984. 8 Tab, 15 Ref.

Descriptors: *Water stress, *Water deficit, *Soybeans, Crop yield, Cultivars, Plant growth, Soil water, Irrigation.

Moisture is a major factor limiting yield in most areas where soybeans are grown. Moisture stress experiments were conducted under field conditions using four determinate soybean cultivars of Group VI maturity, in 1980 and 1981 on a Captina silt loam at Fayetteville, AR. The experiments consisted of two moisture stress treatments which were

initiated at the R2 and R4 growth stages and a control which was irrigated as needed throughout the season. Measurements were made on both roots and aboveground plant parts. When a moisture deficit was initiated by placing black plastic over the plots at either R2 or R4, seed yield was significantly reduced both years. A moisture deficit following application of plastic of R2 reduced yield more than at R4 in 1981, but the reverse was found in 1980, an extremely dry year. A moisture deficit initiated at R4 significantly reduced seed size and seed number both years whereas seed size was not significantly reduced either year by deficits initiated at R2. The cultivar Sohoma produced significantly larger seeds than the other three cultivars when plants were moisture stressed at R4. No significant cultivar x moisture stress interactions involving seed yield were observed in either year; however, there was a definite trend for seed yields of Sohoma to be reduced less by moisture deficits initiated at stage R4 in both 1980 and 1981. Percent flower and pod shedding did not appear to be affected to any great extent by the moisture stress treatments in either year. Flower production and shedding apparently are not important factors causing yield reductions under soil water deficits in these experiments. Moisture stress appeared to reduce root density under the row at both growth stages. Soybean cultivars differ to some extent in their response to soil moisture deficits, but these differences generally are small and not consistent in different environments. (Moore-IVI)
W86-00465

RELATIONSHIPS BETWEEN CROP WATER STRESS INDEX AND ALFALFA YIELD AND EVAPOTRANSPIRATION,
New Mexico Agricultural Experiment Station, Las Cruces.
A. S. Abdul-Jabbar, D. G. Lugg, T. W. Sammis, and L. W. Gay.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 454-461, March/April, 1985. 4 Fig, 7 Tab, 24 Ref.

Descriptors: *Evapotranspiration, *Water stress, *Crop yield, *Alfalfa, Evaporation, Transpiration, Water loss, Canopy temperature, Aerodynamic resistance,.

Two methods of determining Crop Water Stress Index (CWSI) were compared for alfalfa. The first method was the graphic method of Idso using the temperature differential between canopy and air. A significant relationship was obtained between evapotranspiration (E) and potential evaporation (Ep). The second method uses energy balance considerations to determine CWSI. Aerodynamic resistance r(a), which is needed to calculate CWSI, was evaluated using three different methods. The wind profile method overestimated r(a) and, accordingly, underestimated CWSI. The CWSI estimated using this method was not well correlated with measured E/Ep or dry forage yield. Overall, the CWSI concept provided a good indicator of alfalfa evapotranspiration and yield, and has potential to be used in irrigation scheduling. Values of CWSI can be determined rapidly using an infrared thermometer or using meteorological data. (Baker-IVI)
W86-00468

TRANSPIRATION RATE AND WATER USE EFFICIENCY OF SOYBEAN LEAVES ADAPTED TO DIFFERENT CO2 ENVIRONMENTS,
Florida Univ., Gainesville. Dept. of Agronomy.
For primary bibliographic entry see Field 2D.
W86-00483

RESPONSES OF C4 GRASSES TO ATMOSPHERIC CO2 ENRICHMENT. II. EFFECT OF WATER STRESS,
Duke Univ., Durham, NC. Dept. of Botany.
N. Sionit, and D. T. Patterson.
Crop Science, Vol. 25, No. 3, p 533-537, May/June, 1985. 4 Fig, 26 Ref. NSF grants DEB78-23640 and DEB80-21312.

Descriptors: *Water stress, *Grasses, *Carbon dioxide, Conductance, Photosynthesis, Stomatal transpiration, Leaves, Water potentials.

Water relationships and photosynthetic and stomatal responses of four different species of C4 grasses to increases in atmospheric CO2 concentration under water stress conditions were studied. Water and osmotic potentials of the leaves of the plants grown at both CO2 levels declined slowly for 3 to 6 days after watering ceased, then declined more rapidly toward the end of the stress period. The rate of decline in leaf water potential and the minimum values reached at the end of the stress cycle differed among the species. Leaf water potentials of the plants grown at the high CO2 concentration declined more slowly and maintained higher values at the end of the stress period than those of plants grown at low CO2 concentration. Osmotic potentials also declined more in the leaves of plants grown at low CO2 than in those grown at high CO2. Plants grown at high CO2 maintained a more positive turgor pressure at the end of the stress cycle than the plants grown at low CO2 concentration. The minimum leaf turgor pressure attained during water stress in these studies varied among species and was different at different CO2 concentrations. Wilting was observed only in one species grown at 350 micromol/mol CO2. High CO2-grown plants had greater net photosynthetic rates than low CO2-grown plants prior to water stress. There is presumably an adaptive advantage to high CO2-grown plants in maintaining higher leaf water potential under water stress conditions. Under the conditions of water stress, the stomata of the four C4 species grown in high CO2 do not change significantly but the leaves maintain greater turgor and higher net photosynthetic rates compared to those of the low CO2-grown plants. (Baker-IVI)
W86-00484

POTENTIAL FOR USING LEAF TURGIDITY TO SELECT DROUGHT TOLERANCE IN COTTON,
Agricultural Research Service, Lubbock, TX. Plant Stress and Water Conservation Research Unit.
J. E. Quisenberry, C. W. Wendt, J. D. Berlin, and B. L. McMichael.
Crop Science, Vol. 25, No. 2, p 294-299, March/April, 1985. 2 Fig, 5 Tab, 17 Ref.

Descriptors: *Drought resistance, *Leaves, *Turgidity, *Cotton, Water potential, Water stress, Photosynthesis, Water use efficiency, Biomass, Conductance, Wilting.

A comparison was made of growth rates, physiological responses, and seed cotton yield under water stressed field conditions between cotton strains that differed in ability to maintain leaf turgidity under dry field conditions. The observed variability in leaf turgidity among cotton germplasm is potentially useful in the development of drought tolerant germplasm. The nonflowering, nonwilting T25 strain produced more shoot biomass than did the nonflowing, wilting T169 strain under water deficit field conditions, and under glass house conditions, T25 produced more biomass per unit of transpired water than did T169. When genes for the day-neutral flowering response from Lubbock Dwarf were introgressed into the two strains, populations and selected lines showed a significant yield advantage for the T25 germplasm over the T169 germplasm under water deficit field conditions. The physiological data suggest that T25 reduces water loss under optimal water conditions through reduced leaf conductances which allows T25 to use this saved water to keep its stomata partially open longer and thus fix C and grow longer when seasonal soil water is limited. (Baker-IVI)
W86-00486

COMPARATIVE EFFECTS OF REPEATED CYCLES OF WATER STRESS ON GROWTH AND APPARENT DINITROGEN FIXATION OF LADINO AND STRAWBERRY CLOVERS,
California Univ., Davis. Dept. of Agronomy and Range Science.
K. L. Johnson, and C. A. Raguse.
Crop Science, Vol. 25, No. 2, p 299-306, March/April, 1985. 2 Fig, 3 Tab, 32 Ref.

Descriptors: *Water stress, *Plant growth, yield, Soil water, Drought, Leaves, Wate tial, Nitrogen fixation, Temperature effects

The effects of repeated short-term cycle moisture depletion on canopy temperat water potential, and nodule hydration as of plant stress were examined. The rel between repetitive short-term water stre visible wilting) and apparent N2 fixation tenance of vegetation growth was determi response to stress can be generalized in three categories. First, responses which re diurnal, cyclic changes in the environment similar responses which are demonstrate period of 2 to several days but are revers third, longer-term responses which are from integration of effects of combined repeated short-term influences. Daily var the differential between canopy and air ture provided an example of the first s sponse. Short term, cyclic fluctuations water potential, nodule hydration, and a reduction activity demonstrated the sec decreases in total plant dry matter and N as decreased accumulation of leaf an growth, exemplified the third. Results of t and straawberry clover experiments sugge stress events of moderate (reversible) im repeated at close intervals, resultant lon reductions in growth can lower above-gro duction of stem and leaf tissue by as much within time periods equivalent to a typ production or pasture rotation cycle. (Ba
W86-00487

EFFECTS OF N FERTILITY ON WATER RELATIONS AND STOMAT SPONSES TO WATER STRESS IN IRRI COTTON,
Agricultural Research Service, Phoeni Western Cotton Research Lab.
J. W. Radin, J. R. Mauney, and G. Guinn.
Crop Science, Vol. 25, No. 1, p 110-115, J February, 1985. 5 Fig, 3 Tab, 19 Ref.

Descriptors: *Crop yield, *Water stress, tion practices, *Water use efficiency, Leaves, Water potentials, Stomatal trans Conductance, Osmotic pressure.

The effects of N fertility on water relati stomatal behavior of irrigated cotton in were explored and those effects were com effects on yield and water use efficiency High levels of N caused stomata to remain very low osmotic potentials in irrigated during the early part of the fruiting cycle, effect was lost as the season progressed. stomata of high-N plants closed at an pressure considerably below the wilting p September, closure occurred much close wilting point. In low-N plants, stomatal was more closely associated with the wilti throughout the season. The changing ston havior of high-N plants was apparently re petiole NO3-N levels but not to total leaf effects of low N on plant water relations an use were such that 10-cm irrigations prod much yield as, and a higher WUE than irrigations. (Baker-IVI)
W86-00488

SIMULATION OF MOISTURE STRE FECTS ON SOYBEAN YIELD COMPO IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agri Engineering.
G. E. Meyer.
Transactions of the American Society of tural Engineers, Vol. 28, No. 1, p 118-12 ary/February, 1985. 6 Fig, 7 Tab, 46 Ref.

Descriptors: *Water stress, *Crop yield beans, *Nebraska, Simulation, SOY OARDC, Model studies, Irrigation effect growth, Overwatering.

The most recent improvements and modif to the model SOYMOD/OARDC are d

with explanations of how the model can be to study water stress interactions with soy- A sensitivity study is provided involving ent weather sequences to simulate how the an crop responds to these conditions. Supple- l water can be applied to an indeterminant an crop based on soil moisture depletion the critical stages of reproductive growth il) to reduce moisture stress during these ls. The simulations suggest that there can be nber of complicating factors for achieving soybean seed yields with irrigation. Overwa- or large water supply during vegetative may elicit competitive response of the leaves trogen with later fruit development which esult in smaller size fruit. Optimization analy- ould be applied to determinate soybean irri- studies to determine when to apply water ill elicit a significant yield response. As the ological system becomes better quantified, ater simulation will play an important role in optimization studies. Some of the new fea- and capabilities of REALSOY have been strated for research and teaching activities. odel is quite flexible and upgradable. It can st estimates of soybean seed size and yield or te a complete analysis of physiological data console. (Baker-IVI)
0491

ON PLANT RESPONSE TO WIND AND R STRESS,
ltural Research Service, Lubbock, TX. ing Systems Research Service.
Barker, J. L. Hatfield, and D. F. Wanjura.
ctions of the American Society of Agricul- Engineers, Vol. 28, No. 1, p 194-200, Janu- bruary, 1985. 6 Fig, 4 Tab, 16 Ref.

ptors: *Cotton, *Wind, *Water stress, Crop Phenology, Shelter, Water use, Air tempera- egression equations.

plant phenology was observed in a shel- environment for six different planting dates mpared to cotton grown in an unsheltered The shelters consisted of a snow fence and ed a 35% reduction in wind velocity 0.2 m the crop for the season. Increased plant earlier squaring, earlier boll set and more nd biomass were observed for sheltered when compared to the unsheltered cotton. nsheltered cotton used less water than the ed cotton. Regression equations were devel- o predict plant height and the change in eight as a function of age of the plant, wind ent, daytime temperature and nighttime ature. (Author's abstract)
0503

R USE EFFICIENCY IN A SOYBEAN : INFLUENCE OF PLANT WATER SS,
al Oceanic and Atmospheric Administra- ak Ridge, TN. Air Resources Atmospheric ence and Diffusion Lab.
Baldocchi, S. B. Verma, and N. J. berg.
ltural and Forest Meteorology, Vol. 34, No. -65, February, 1985. 6 Fig, 3 Tab, 41 Ref. al Research Project 11-33 and Nebraska ltural Experimental Station Project 11-049.

ptors: *Water use efficiency, *Soybeans, stress, Photosynthesis, Evapotranspiration, dioxide, Stomatal resistance, Soil water, ater potential, Leaves.

rements were made in 1980 over a fully- ped soybean (Glycine max (L.) Merrill) at Mead, Nebraska to determine how crop status influences photosynthesis, evapotran- on and water use efficiency. Water use effi- was calculated in terms of the CO2-water atio (CWFR). Micrometeorological tech- were used to measure the exchange rates of nd water vapor above the crop canopy. water status was evaluated by reference to etric soil moisture (theta sub v), stomatal ace (r sub s), and leaf water potential (psi) ements. Stomatal resistance (r sub s) was independent of psi when the latter was greater than -1.1 MPa; r sub s increased sharply as psi dropped below this threshold. Canopy CO2 exchange (F sub c) decreased logarithmically with increasing r sub s under strong irradiance. Although Fc was found to be strongly correlated with r sub s, the influence of low values of psi and of high air temperature cannot be discounted since these factors affect the enzymatic reactions associated with photosynthesis. Stomatal closure also reduced evapotranspiration and influenced the partitioning of net radiation. Under strong irradiance the CO2 water flux ratio (CWFR) decreased with increasing stomatal resistance. This observation is at variance with predictions of certain early 'resistance' models, but substantiates predictions of some recent models in which leaf energy balance considerations are incorporated. (Author's abstract)
W86-00505

EVALUATING PLANT AND CANOPY RESISTANCES OF FIELD-GROWN WHEAT FROM CONCURRENT DIURNAL OBSERVATIONS OF LEAF WATER POTENTIAL, STOMATAL RESISTANCE, CANOPY TEMPERATURE, AND EVAPOTRANSPIRATION FLUX,
National Aeronautics and Space Administration, Greenbelt, MD. Hydrological Sciences Branch.
B. J. Choudhury, and S. B. Idso.
Agricultural and Forest Meteorology, Vol. 34, No. 1, p 67-76, February, 1985. 7 Fig, 25 Ref.

Descriptors: *Plant water potential, *Stomatal resistance, *Canopy temperature, *Evapotranspiration, *Wheat, Leaves, Diurnal variation, Soil water, Transpiration, Mathematical equations.

Concurrent observations of leaf water potential, stomatal diffusion resistance and canopy temperature were made on two plots of wheat (Triticum aestivum L. cv. Anza) growing at Phoenix, Arizona under two different soil water conditions. These data were further complemented by weather observations and lysimeter measurements of total evaporative water loss from the plots. Transpiration fluxes for each plot were estimated by an aerodynamic-energy balance approach and compared with the lysimeter data. Plant resistances were computed from the transpiration flux results and the leaf water potential measurements using van den Honert's equation, while canopy resistances were also computed from the transpiration flux using Monteith's equation. The calculated plant resistance decreased by a factor of almost two from morning to mid-afternoon whereas the ratio of canopy and stomatal resistance was constant during most of the day. (Author's abstract)
W86-00506

YIELD, COMPOSITION AND QUALITY OF TALL FESCUE AS INFLUENCED BY N FERTILITY AND SOIL WATER AVAILABILITY,
Russell Research Center, Athens, GA.
D. P. Belesky, S. R. Wilkinson, and F. McHan.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 8, p 945-968, July, 1984. 10 Tab, 20 Ref.

Descriptors: *Fescue, *Crop yield, *Water stress, *Nitrogen, *Fertilizers, Soil water, Forages, Plant growth, Leaves, Stomatal resistance, Transpiration, Toxicosis.

A study was designed to evaluate yield, quality and composition of tall fescue (Festuca arundinacea Schreb.) as influenced by water stress under 0, 100, and 400 kg N/ha during autumn in the southeastern U.S. Four replicates of each treatment were imposed in a completely random design in the field. The experiment was conducted in two successive years with treatments applied to an adjacent area to eliminate residual or carry-over effects. Water status was verified by gypsum block, tensiometer, and determination of leaf stomatal resistance. Plant tissue was harvested three times during autumn and again in the following spring. Forage yield total was not significantly affected by soil water stress, apparently due to compensatory growth during recovery periods. Soil water appeared to be more rapidly depleted under 400 kg N/ha than other N treatments. Increasing N fertilizer significantly increased leaf area, leaf number, and was inversely related to the number of senesced leaves. Stomatal resistance was increased under water stress conditions when N was limited (ON) but not when 400 kg N/ha was applied. Consequently, plots receiving 400 kg N/ha continued to transpire even during periods of limited soil water, but transpired less during subsequent stress periods. Kjeldahl and NO3-N were increased by application of fertilizer N and only NO3-N was significantly increased by water stress in this study. Although high input of fertilizer N minimized the impact of mild water stress on the physiological response of tall fescue, eventual stand loss occurred. Water stress had no effect upon nonstructural carbohydrates, in vitro dry matter digestibility or the elements P, K, Ca, Mg, Cu and Zn. Consequently the factors associated with the expression of tall fescue toxicosis during autumn are more subtle in expression, and do not appear to be associated with alterations in major nutritive components. (Author's abstract)
W86-00512

WATER RELATIONS IN XEROPHYTIC PLANTS (VODNI PROVOZ SUCHOMILNYCH ROSTLIN),
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Faculta Lesnicka.
M. Penka.
Acta Universitatis Agriculturae (Brno) Series C (Facultas silviculturae), Vol. 52, No. 3-4, p 243-257, 1983. 5 Fig, 34 Tab.

Descriptors: *Xerophytes, *Water relation, Transpiration, Drought resistance, Succulents, Halophytes, Soil-water-plant relationships, Roots, Shoots, Plant physiology.

The objective was to study the water relations in xerophytic plants. The term 'xerophytes' was defined and a classification of the plants suggested (sclerophilous, malacophilous, stenohydric, eurihydric, hydrostable, hydrolabile plants). Attention was also given to division of the plants as based on the depth of rooting with respect to their water intake and outgo (water balance). Moreover, the root:shoot (R/S) ratio was evaluated, account being taken of the anatomy of vascular bundles and their conductivity. As for the water relations in the shoot system, further essential features were assessed, primarily the conduction and outgo of water in relation to anatomical characteristics of vascular bundles and to anatomical structure of leaves, of assimilating stems. The Schimper theory on xerophytism was confronted with Maximoff's views of xerophytes approached from the physiological standpoint. The difference between transpiration and resistance of plants against drought was discussed in detail; high resistance against drought was found to be a feature characteristic of all xerophytes. The observations indicated that xerophytes, if supplied well by water, either equalled to or exceeded the transpiration of mesophytes and hygrophytes. Basing on the ability to resist the impact of drought, xerophytes would be divided into following categories: annual, sclerophilous evergreen, xeromorphous leafless, perennial deciduous, reducing transpiration area during the spell of dry weather, and succulent. The last category of xerophytes was subdivided into leaf succulents, stem succulents, and underground succulents. Since halophytes stand near xerophytes, the oligotrophic plants into which halophytes are usually included were classified first. Of individual features of the water relations were discussed mainly: water outgo, osmotic conditions, and physiological drying. The terms 'hygrohalophytes' and 'xerohalophytes' were also mentioned, in relation to variations in the soil moisture and salts. (Author's abstract)
W86-00592

SOIL-PLANT-WATER MODEL WITH A CASE STUDY IN A FORESTED CATCHMENT,
Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Ressources Renouvelables.
T. Huillet, and J. Lauga.
Ecological Modelling, Vol. 27, No. 3/4, p 235-250,

Group 2I—Water In Plants

April, 1985. 8 Fig, 2 Tab, 25 Ref.

Descriptors: *Water use, *Plants, Model studies, Forest watershed, Catchment areas, Hydrologic models, Water budget, Evaporation, Transpiration, Mathematical models.

A model is presented to sketch the mean features of soil-plant-atmosphere interactions. Many earlier studies have been interested in mathematical modelling of water cycling in small watersheds. Among so called conceptual models of processes there is a distinction between spatial models taking into account some aspects of spatial heterogeneity and lumped models such as the CREC model. The main features of the CREC model are described. The dynamic model proposed covers a period of 1 year, and the spatial unit chosen is a forested catchment area. The transpiration process is shown to differ from evaporation over a water surface as soon as a water deficit develops, corresponding to the closure of stomata and a sharp reduction in transpiration, although the evaporative power of the air may still be strong. The mathematical model is first discussed with reference to hydrological processes over the watershed, followed by the addition of state equations which describe the living part of the watershed and its water consumption processes. The ability of the soil-plant-atmosphere model presented to separate transpiration and evaporation rates makes it possible to grasp some characteristics of the daily evolution of these variables. The calibration is not yet reliable enough but it provides a useful guide for future data collection. Some variables, such as mean daily leaf water potential, are biologically ill-defined. To improve the model optimization should be possible, although it should be noted that the uniqueness of the solution is not guaranteed with scarce data usually found in ecology. (Baker-IVI)
W86-00595

CANOPY DYNAMICS OF EUCALYPTUS MACULATA HOOK. III; EFFECTS OF DROUGHT,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
E. W. Pook.
Australian Journal of Botany, Vol. 33, No. 1, p 65-79, 1985. 8 Fig, 4 Tab, 26 Ref.

Descriptors: *Drought, *Eucalyptus, *Canopy, New South Wales, Leaf-shedding, Wilting, Bark-splitting, Defoliation, Drought resistance, Trees, Water deficit.

The severe 7-month drought in coastal and adjacent tablelands regions of New South Wales in the latter half of 1980 caused heavy leaf-shedding, wilting of persistent foliage and bark-splitting in forest eucalypts. Defoliation of individual sample trees of Eucalyptus maculata ranged from 50 to 97% of pre-drought leaf area. Leaf area index of a stand of E. maculata was reduced from c. 4.3 to 0.8. E. maculata was less susceptible to drought than E. globoidea and E. pilularis but more susceptible than E. paniculata in mixed forest on the same site. Rapid recovery of the canopy occurred in autumn after the break of the drought and leaf areas of all sample trees attained pre-drought values or above by summer 1981-82. Leaf-shedding in response to severe water deficit appears to have been of adaptive significance in enhancing tree survival in a drought of this duration. (Author's abstract)
W86-00596

2J. Erosion and Sedimentation

HYDROLOGY, HYDRAULIC, AND SEDIMENT CONSIDERATIONS OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 6G.
W86-00336

EFFECTS OF SOIL EROSION ON SOYBEAN YIELDS AND CHARACTERISTICS OF CECIL-PACOLET SOILS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. White, R. R. Bruce, A. W. Thomas, G. W. Langdale, and H. F. Perkins.
Erosion - Productivity Investigations, 1982-83, Research Report No. IRC 060184, June 1984. 36 p, 11 Fig, 11 Tab.

Descriptors: *Soil erosion, *Erosion, *Crop production, *Crop yield, *Soybeans, *Georgia, *Plant growth, Baseline studies, Soil water, Piedmont, Rainfall, Growth, Data collections, Infiltration, Soil horizons, Potassium, Magnesium, Phosphorus, Minerals, Soil conservation.

Cooperative studies on 24 farm fields over a seven-county area in the Southern Piedmont of Georgia were conducted in 1982 and 1983 to evaluate the effects of soil erosion on soybean growth and production. Replicated plots were established on Cecil-Pacolet soils in slightly, moderately, and severely eroded areas in each field. Severely eroded soils had markedly lower levels of P compared to slightly eroded soils, while K and Mg were lowest on slightly eroded areas. Erosion reduced plant growth, yields, and stands. In 1982, bean yields averaged 41.3, 28.1, and 19.8 bushels/acre for the slightly, moderately, and severely eroded areas. Analysis of rainfall data for both years showed a 2.7 bushel/acre yield increase per inch of rainfall on the slightly eroded soils. Soil water studies in 1982 showed that slightly eroded sites were well supplied with water more than 40% of the time, compared with 29 and 27% of the time on moderately and severely eroded sites, respectively. These results suggest that there is less infiltration of rainfall into eroded soils, and increased rainfall does not necessarily increase yields on eroded soils. These findings also indicate that erosion is a very serious problem on Southern Piedmont soils and can cause drastic reduction in crop yields.
W86-00339

EFFECTS OF SOIL EROSION ON SOYBEAN PRODUCTION IN THE SOUTHERN PIEDMONT OF GEORGIA IN 1982,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 4C.
W86-00340

PHOTOGRAMMETRIC TECHNIQUES FOR MONITORING SOIL EROSION,
Georgia Univ., Athens. Dept. of Geography.
R. Welch, T. R. Jordan, A. W. Thomas, and J. W. Ellis.
Photogrammetry - Soil Erosion Investigations 1983, Research Report No. IRC 09083, September, 1983. 22 p, 6 Fig, Tab 1, 5 Ref.

Descriptors: *Monitoring, *Soil erosion, *Photogrammetry, *Photography, *Aerial photography, *Channel erosion, *Gully erosion, *Bank erosion, Soil conservation, Erosion rates.

The potential of photogrammetric techniques for monitoring soil erosion is described along with the work accomplished by the USDA-ARS Southern Piedmont Conservation Research Center and the University of Georgia between March 1982 and September 1983. Photogrammetry can be used to obtain highly accurate X, Y, and Z terrain coordinates of fragile erosion surfaces recorded on stereo photographs. Analog photogrammetric techniques usually require the use of costly stereo-plotters and the services of a trained photogrammetrist. Analytical photogrammetric techniques involve the measurement of image coordinates and their transformation into X,Y,Z terrain coordinates by computational procedures. Four sites on the Southern Piedmont Conservation Research Center property near Watkinsville, Georgia are being monitored by sequential photogrammetry for stream channel erosion, roadbank-type erosion, gully formation and field erosion, respectively. Further work is needed on the use of aerial photography in conjunction with photogrammetric methods to monitor the topographical changes of larger areas.
W86-00342

BEACH CHANGES AT NAUSET INLET, C COD, MASSACHUSETTS: 1670-1981,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W86-00379

FACTORS INFLUENCING INORGANIC BIDITY IN A GREAT PLAINS RESERV
Oklahoma State Univ., Stillwater. Dept. of Z gy.
For primary bibliographic entry see Field 2H.
W86-00440

SEDIMENT LOSSES FROM CROPLAND ROWS OF DIFFERENT GRADIENTS,
Science and Education Administration, Ox MS. Sedimentation Lab.
L. D. Meyer, and W. C. Harmon.
Transactions of the American Society of Ag tural Engineers, Vol. 28, No. 2, p 448-461, M April, 1985. 3 Fig, 6 Tab, 23 Ref.

Descriptors: *Sedimentation, *Erosion, *Soil *Furrows, Cropland, Gradients, Simulated rai Slope, Rill erosion, Rainfall, Runoff.

Soil losses from fields with bedded or ridged depend greatly on the row-furrow gradient row length. Bedded rows with furrow grad ranging from 0.5 to 6.5% were subjected to a of simulated rainstorms. Erosion from the sideslopes was the same at all furrow grad Furrow losses increased rapidly between 0.5 2.0% gradient, increased only slightly from to 5.0%, and again increased rapidly betwee and 6.5%. Losses increased more than 5 tim intensity was increased from 26 to 70 mm/h i sity and more than doubled again from 70 to mm/h. When longer rows were simulated adding inflow to the furrows, soil losses incr only slightly faster than furrow length until r rilling began. Computation of USLE slope le exponents along the furrows gave values of 0.1 at 0.5% gradient and near 0.2 at 2.0% 3.5%. All sediment lost from 0.5% furrows er from the row sideslopes. For furrows of 2.0 and 5.0% at lengths less than 30 m, more o lost sediment eroded from the row sideslopes from the furrows. More of the sediment lo 6.5% gradient eroded from the furrows for le greater than 10 to 20 m. The clay sized portio the total sediment lost from the furrows decr as furrow gradient increased, although the am of loss for this size was about constant u rilling was serious. Some deposition of silt sand sized sediment in the furrows occurre 0.5% gradient, but all such sizes were transpo at gradients of 2.0% and steeper. Sediment sco by flow along steeper and longer furrows predominantly silt and sand sized. (Baker-IVI)
W86-00467

FIELD EROSION ESTIMATED FROM 1 ACTIVITY MEASUREMENTS,
Wisconsin Univ.-Madison. Dept. of Agricul Engineering.
J. R. McHenry, and G. D. Bubenzer.
Transactions of the American Society of Agr tural Engineers, Vol. 28, No. 2, p 480-496, Ma April, 1985. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Cesium radioisotopes, *Soil ero *Estimating, Soil loss, Erosion control, Cul tion, White Clay Lake Watershed, Wisconsin, out.

Soil samples were collected from fields wooded sites in White Clay Lake Watershed, consin. The watershed consists of some 1100 rolling land largely devoted to intensive agr ture. The cultivated fields sampled are farme an oats-alfalfa-corn rotation. Fallout Cs-137 centrations in the soil pedons was used as a t or tag in studies conducted in this area in 197 1976. In 1980, after 4 to 6 years of addit cultivation, the fields were again sampled an 137 measured. The results demonstrate that a siderable movement of soils occurs within the tivated fields. The fallout of Cs-137 was de

l as a tracer of soil particle movement to
ate erosion rates and amounts of soil move-
. A comprehensive within field budget of soil
ment can be determined by using the Cs-137
dure together with a grid of sampling sites.
ates of transport of soil into and out of the
also can be made. These measurements can be
at any given time. Accuracy of the soil loss
in measurements will depend on the accuracy
e determination of the base level of Cs-137
nt and on the detail of the sampling grid of
rofiles. If desired, predetermined precision for
measurement of Cs-137 is possible by use of
ble nuclear counting techniques. (Baker-IVI)
00472

MATING SOIL DETACHMENT CAUSED AINDROP IMPACT,
ska Univ., Lincoln. Dept. of Agricultural
eering.
rimary bibliographic entry see Field 2B.
00494

RRILL SOIL EROSION - PART I: DEVEL-ENT OF MODEL EQUATIONS,
ska Univ., Lincoln. Dept. of Agricultural
eering.
Gilley, D. A. Woolhiser, and D. B.
norter.
actions of the American Society of Agricul-Engineers, Vo. 28, No. 1, p 147-153 and 159,
ry/February, 1985. 4 Fig, 4 Tab, 34 Ref.

iptors: *Soil erosion, *Rain, *Interrill ero-*Model studies, Mathematical equations,
ent transport, Overland flow, Rainfall inten-

equations were evaluated which are used to
te interrill soil erosion. The equations devel-
erve to complement existing erosion models.
ccuracy of comprehensive erosion models
e improved if more reliable formulas for
ting overland flow depth, soil detachment
diment transport capacity are identified. The
osion process in the interrill overland flow
is governed by soil detachment from rain-
mpact and the transport of soil materials by
v overland flow. Both of these processes
e significantly influenced by depth of over-
ow. Model equations are identified which
e the effects of varying overland flow depth
detachment and transport. Overland flow
was determined by the Darcy-Weisbach
n. The Darcy-Weisbach friction coefficient
timated from an empirical relation including
intensity and flow Reynolds number. A
ionless equation was used to predict depths
land flow for varying rainfall intensities and
roughness. Soil detachment by raindrop
was represented as the product of a soil
ment factor and the maximum impact pres-
the soil-water interface caused by raindrop
. Impact pressure was estimated from an
al equation involving drop impact velocity,
liameter and water layer depth. Because
p size distribution, drop velocity and over-
ow depth appear explicitly in the detach-
quation, it may prove useful in evaluating
of erosion studies obtained using rainfall
ors with different raindrop characteristics.
diment transport capacity of runoff was
ed as the product of a sediment transport
bottom shear stress and flow velocity.
shear stress was represented as the product
ific weight of water, water depth and chan-
e. This relation appeared to provide proper
es of sediment transport capacity. The data
ed to test the model equations was limited.
mplex, individual erosion mechanisms
better defined, more reliable and compre-
soil erosion models can be developed.
IVI)
0495

RILL SOIL EROSION - PART II: TEST-ND USE OF MODEL EQUATIONS,
ka Univ., Lincoln. Dept. of Agricultural
ering.
illey, D. A. Woolhiser, and D. B.
McWhorter.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 154-159, January/February, 1985. 11 Fig, 2 Tab, 7 Ref.

Descriptors: *Soil erosion, *Rainfall, *Interrill erosion, Rain, Intensity, Mathematical equations, Model studies, Shear stress, Slope, Sediment transport, Overland flow.

The effects of varying discharge and slope steepness on interrill soil erosion was measured. The previously identified model equations were tested on experimentally obtained information. The interrill overland flow range was identified and the influence of slope length on interrill erosion was examined. A rainfall simulator was used to measure interrill runoff and erosion under lab conditions for a Nunn clay loam soil. Discharge and slope steepness were included as experimental variables. Inflow was added at the top of the test section in a portion of the study to simulate greater slope lengths. Soil loss consistently increased with slope steepness when inflow was not added. Greater discharge rates, resulting from addition of inflow, caused larger erosion rates in some instances and reduced rates of erosion in others. In general, rilling was observed to occur at smaller discharge rates as slope steepness was increased. The experimentally obtained information was used to test previously identified model equations. In general, predicted soil loss rates agreed well with measured data. Analyses of experimental information collected in the present study suggest that previously identified detachment and transport relations are appropriate for estimating interrill soil erosion. The overland flow length required for establishment of critical shear stress is expected to change from a few meters to several hundred meters as slope gradient is decreased from 10 to 1%. Slope length affects interrill soil erosion because water depth increases with downslope distance. Water depth in turn influences soil detachment and overland flow sediment transport capacity. Soil erosion at a particular downslope distance is dictated by soil detachment or sediment transport capacity characteristics existing at that particular location. (Baker-IVI)
W86-00496

SOIL LOSS FROM COTTON WITH CONSERVATION TILLAGE,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 4D.
W86-00497

SEDIMENTATION IN A BLAST-ZONE LAKE AT MOUNT ST. HELENS, WASHINGTON - IMPLICATIONS FOR VARVE FORMATION,
New Mexico Univ., Albuquerque. Dept. of Geology.
R. Y. Anderson, E. B. Nuhfer, and W. E. Dean.
Geology, Vol. 13, No. 5, p 348-352, May, 1985. 3 Fig, 1 Tab, 18 Ref. NAF grant EAR 81-13072.

Descriptors: *Sedimentation, *Varves, *Coldwater Lake, *Washington, *Mount St. Helens, Volcanoes, Erosion, Vegetation, Sediment yield, Turbidites, Precipitation, Seasonal variation.

The basin that holds Coldwater Lake was formed when a debris avalanche from the May 18, 1980, eruption of Mount St. Helens, Washington moved down the Toutle River and blocked the confluence of Coldwater and south Coldwater creeks. The drainage area of the lake contains highly erodible materials. Vegetation was virtually absent from the devastated area after the eruption, and large areas of bare ground were still present at the time of the studies. Sediment collected from June 1982 through August 1984 in traps in the newly formed lake in the blast-impact area recorded a sediment yield that is about two orders of magnitude greater than for comparable basins with vegetation and similar precipitation. Most sediment was mobilized by storms and runoff at the onset of the wet season. The sedimentation response to strongly seasonal precipitation, in the absence of vegetation, produced turbidites and graded annual couplets. The seasonal shift from turbidite to nonturbidite deposition, followed by the slow accumulation of clay, was a consequence of the strongly seasonal distribution of precipitation. Texturally and structurally, the laminated and graded silt layer and the silt-clay couplets bear a close resemblance to some of the graded clastic varves forming in proglacial lakes. (Moore-IVI)
W86-00517

MODELLING OF 210PB BEHAVIOUR IN THE CATCHMENT AND SEDIMENT OF LAKE TALI KARNG, VICTORIA, AND ESTIMATION OF RECENT SEDIMENTATION RATES,
Melbourne Univ., Parkville (Australia). Marine Chemistry Lab.
J. D. Smith, and T. F. Hamilton.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 15-22, 1985. 2 Fig, 2 Tab, 22 Ref.

Descriptors: *Lead radioisotopes, *Lake sediments, *Lake Tali Karng, *Victoria, Sedimentation rate, Catchment area, Model studies.

Lake Tali Karng, the only natural deep-water highland lake in Victoria, Australia, is situated at an altitude of 915 m on the south side of the Victorian Alps. A sediment core was taken from the deepest part of the lake. The flux of unsupported Pb-210 to the sediment is about 145 mBq/sq cm/year. Over the last 100 years, about 75 cm of sediment has accumulated at an average rate of 150-200 mg/sq cm/year. Calculations using two models to convert Pb-210 activity-depth profiles to age-depth profiles indicate that the sedimentation rate has increased slightly over the last 100 years. It is estimated that about 14% of the Pb-210 falling in the catchment reaches the lake sediment, but depending on the assumptions made, the possible range is 7-60%. The contribution of Pb-210 from the catchment may be related to the rugged topography of the region, with some influence from the above-average uranium concentrations in the rocks. Lake Tali Karng with its unique environment is an excellent site for the study of the behavior of Pb-210 in a catchment and for development of models of relationships between different sources of Pb-210. (Moore-IVI)
W86-00520

SEDIMENTATION OF PARTICULATE MATERIAL IN NORDASVANNET, A HYPERTROPHIC, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
For primary bibliographic entry see Field 2L.
W86-00527

STATISTICAL MODELING OF HISTORIC SHORE EROSION RATES ON THE CHESAPEAKE BAY IN MARYLAND,
Naval Academy, Annapolis, MD. Dept. of Mathematics.
R. K. Spoeri, C. F. Zabawa, and B. Coulombe.
Environmental Geology and Water Science, Vol. 7, No. 3, p 171-187, 1985. 7 Fig, 8 Tab, 75 Ref.

Descriptors: *Statistial models, *Shore erosion, *Chesapeake Bay, *Maryland, Erosion rate, History, Storms, Tides, Waves, Littoral drift, Regressionn analysis, Discriminant analysis.

Few strong relationships exist along the Chesapeake Bay shoreline between the historic erosion rate and the distribution of any of several coastal parameters which were defined and tested using traditional regression and discriminant analysis procedures. To develop a simple predictive equation for shore erosion that could be used by coastal managers, the entire Chesapeake Bay shoreline was partitioned into naturally occurring reaches 2-5 km in length, and the historic erosion rate on each reach was modelled as a function of five variables: (a) shoreline type; (b) '100-year' storm surge height; (c) mean tidal range; (d) wave climate; and (e) potential littoral drift rate. The statistical analysis yielded a multiple correlation coefficient (r sq) of 30.8%; discriminant analysis showed only the first two variables listed above are useful predic-

tors (i.e., statistically significant) of historical erosion rates. A 95-mile portion of the same bay shoreline in Queen Anne's and Talbot counties was then partitioned into shorter reach lengths (1/2-2 km) and more variables were included. The multiple correlation coefficient (r sq) improved slightly to 32.9%, but only shoreline type and potential litoral drift rate were found to be useful predictors of historic erosion rates. Curiously, the ability to model statistically the historic shore erosion rate is best on those reaches already substantially protected by structures. For Queen Anne's and Talbot counties, the multiple regression coefficient improved to 61.5% when only reaches 1/2-2 km in length protected by structures were considered. (Author's abstract)
W86-00556

SEDIMENT ACCUMULATION RATES IN AN ALASKAN ARCTIC LAKE USING A MODIFIED 210PB TECHNIQUE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2H.
W86-00612

2K. Chemical Processes

MATHEMATICAL MODELING OF COMPLEX FORMATION OF METALS AND ITS APPLICATION TO THE INTERPRETATION OF PHYSICOCHEMICAL PROCESSES IN NATURAL WATERS (MATHEMATISCHE MODELLIERUNG DER KOMPLEXBILDUNG VON METALLEN UND IHRE NUTZUNG BEI DER INTERPRETATION PHYSIKOCHEMISCHER PROZESSE IN NATURLICHEN WASSERN),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
R. Fischer, and H. Reissig.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 3-18, 1984. 9 Fig, 3 Tab, 7 Ref.

Descriptors: *Mathematical models, *Chemical complexation, *Metals, *Natural waters, Physicochemical properties, Ligands, Temperature, Hydrogen ion concentration, Iron, Oxidation.

A mathematical model is presented for the calculation of the concentrations or activities of complex compounds at thermodynamic equilibrium. Ten central atoms and ten ligands which form 400 complexes at the most can be included in the model. Complex stability constants, total concentrations of the central atoms and ligands, temperature and pH-value constitute input quantities. Activity and temperature dependence of the stability constants are covered by respective subprograms. The model is tested by the migration rate of iron(II) within a sand-filled column with a cation-exchange capacity of 1 mval/100 g solid matter: If there is an excess of sulfate, the iron(II)-breakthrough will be considerably earlier, the same holding for the EDTA-complex, whereas by means of EDTA the iron(II) bonded to the soil by ion exchange can be redissolved. In the batch experiment also the rate of oxidation of iron(II) is dependent on the degree of complexing. The model can be extended for dissolving, precipitation and redox processes. (Author's abstract)
W86-00394

EXPERIMENTS ON AEROSOL SCAVENGING BY NATURAL SNOW CRYSTALS, PART I: COLLECTION EFFICIENCY OF UNCHARGED SNOW CRYSTALS FOR MICRON AND SUBMICRON PARTICLES,
Hokkaido Univ., Sapporo (Japan). Div. of Environmental Structure.
For primary bibliographic entry see Field 2B.
W86-00426

RETENTION AND RELEASE OF SELECTED MAJOR AND MINOR METALS BY THE ALTAMAHA RIVER MARSH ECOSYSTEM,
Savannah State Coll., GA. School of Science and Technology.
For primary bibliographic entry see Field 2L.
W86-00431

SEDIMENT ACID NEUTRALIZATION IN SOFTWATER LAKES,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 2H.
W86-00432

FLUCTUATION IN NUTRIENTS DURING TIDAL CYCLES AT OYSTER BEDS IN THE RIVER PENZE (NORTH FINISTERE) (FLUCTUATIONS DES NUTRIMENTS AU COURS DE LA MAREE SUR LES PARCS OSTREICOLES DE LA RIVIERE PENZE (NORD-FINISTERE)),
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
For primary bibliographic entry see Field 2L.
W86-00447

STATE OF METAL IONS IN NATURAL WATERS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
P. N. Linnik, and B. I. Nabivanets.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 335-361, 1984. 1 Fig, 3 Tab, 178 Ref.

Descriptors: *Natural waters, *Metals, *Ions, Chemical complexes, Heavy metals, Organic compounds, Water analysis, Ligands.

Data obtained from the literature and original research showing the concentrations of microelements in oceans, seas, lakes and reservoirs, and rivers; the ratios of complexed and uncomplexed forms of macro- and microelements in some lake waters; and the molecular mass of metal complexing compounds are presented, and metal complexation is reviewed. A research method for determining the state of metal ions in natural waters also is described. Microelements discussed include Fe, Al, Mn, Zn, Cu, Ni, Co, V, Mo, Ti, Rb, Ag, Cr, and Pb. Ratios of aquacomplexes and inorganic compounds to complexes with macromolecular ligands in lake water are given for Mg, Ca, Ba, Fe, Al, Mn, Cu, Zn, Cd, Pb, Ni, Cr, Sc, La, Ce, and Th. Complexing substances involved with Fe include humic compounds, fulvic acids, and dissolved organic compounds, with molecular masses ranging from less than 5,000 to 20,000. Cd, Cu, and Pb have been found complexed with dissolved organic compounds with weights from less than 1,400 to over 45,000; Cu also complexes with fulvic acids and protein-like compounds. Mn is found complexed with dissolved organic compounds of weights from 500-150,000. Hg is found in complexes with dissolved organic compounds of 500-300,000 molecular weight. The most general characteristics of the state of metal ions in natural waters are metal distribution among suspended, colloid-dispersed and truly dissolved forms; concentration of free (noncomplexed) metal ions; charge sign; molecular (ionic) mass of complex or polynuclear compounds; kinetics of the complexing process; degree of strength of metal binding to the complex; and degree of metal oxidation. These characteristics of metal ions were employed to develop a flow chart for determination of the state of metal ions in natural waters. Electrophoresis, ion exchange, diffusion, and filtration methods are among the laboratory methods used in determination of the forms of metal ions. (Rochester-IVI)
W86-00537

RELATIONSHIP BETWEEN ORGANIC CARBON AND CHEMICAL OXYGEN DEMAND,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
L. Prochazkova, and P. Blazka.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 383-392, 1984. 2 Fig, 6 Tab, 23 Ref.

Descriptors: *Organic carbon, *Chemical oxygen demand, *Fate of pollutants, Reservoirs, Ponds, Brooks, Rivers, Sediments, Linear regression analysis.

Data on chemical oxygen demand (COD) give the amount of oxygen required for oxidation under fairly severe conditions. This corresponds to the concentration of organic compounds present if i organic reducing substances are low and negli ble. The chemical oxygen demand/organic carb (COD/OC) ratio was determined for samples fro two ponds, one brook, three rivers and four res voirs. All samples were taken from sampling s tions with a low organic load, (2.6-127 mg/l CO and 0.9-38 mg/l OC). In the course of self-purific tion, the OC concentration in rivers and reservoi decreases to 8 mg/l, whereas ponds reached mi mum values of the same size. The quotient COI OC varies as the mean value for the individu waters between 2.55 in reservoirs and 3.92 ponds. The overall trend of the values in t sequence of pond-river-reservoir is decreasin The variability of the COD/OC ratios both with and between the groups results in artificial int cepts in linear regressions of the two paramete Quotients larger than four may be associated wi sulfur-containing compounds possibly comi from the sediments. The COD/OC ratios may va with the origin of the samples and the use of unified ratio in calculations may cause erro which are not negligible. (Moore-IVI)
W86-00540

NITROGEN, PHOSPHORUS, AND ORGAN CARBON CYCLING IN AN ARCTIC LAKE,
Alaska Univ., Fairbanks. Inst. of Marine Scienc
For primary bibliographic entry see Field 2H.
W86-00611

2L. Estuaries

EVALUATION OF MARSH/ESTUARIN WATER QUALITY AND ECOLOGIC MODELS: AN INTERIM GUIDE,
Army Engineer Waterways Experiment Statio Vicksburg, MS. Environmental Lab.
R. W. Hall.
Miscellaneous paper EL-82-1, January 1982. Fi Report. 24 p, 5 Tab, 91 Ref.

Descriptors: *Estuaries, *Marshes, *Model studi *Water quality, Coastal marshes, Mathematic models, Wetlands.

This report presents water quality and ecologi problems in coastal marshes and estuaries, sugge applicable modeling approaches to problem so tion, and provides the basis for the modeling r ommendations through a brief summary of wa quality and ecological modeling in the mars estuarine environment. (Author)
W86-00314

COLUMBIA RIVER ESTUARY HYBR MODEL STUDIES: REPORT 4, ENTRAN CHANNEL TESTS,
Army Engineer Waterways Experiment Statio Vicksburg, MS. Hydraulics Lab.
W. H. McAnally, N. J. Brogdon, and J. P. Stewart.
Technical Report HL-83-16, September 1983. p, 5 Fig, 20 Tab, 101 Plates, 9 Ref.

Descriptors: *Estuaries, *Channels, *Navigati *Shoals, *Model studies, *Hydraulic mod *Dredging, Columbia River estuary, Channel i provement.

A hybrid modeling approach using a fixed-b physical model, numerical models, and analyti techniques was used to study navigation chan shoaling at the mouth of the Columbia Riv Sixteen plans for reducing channel maintena dredging at the existing 48-ft depth and at 55- 60-ft depths were tested. Effects of the plans tides and currents were found to be subtle. N deepening plans had minor effects on salinity int sion while channel deepening increased salini by 1 to 6 parts per thousand up to about mile Only one stuctural plan reduced shoaling bel base conditions for the 48-ft channel. Chan deepening increased shoaling considerably.
W86-00357

NG ISLAND SOUND THAMESVILLE
AL-FLOOD MANAGEMENT WATER RE-
URCES STUDY, NORWICH, CONNECTI-
T.
ps of Engineers, Waltham, MA. New England

primary bibliographic entry see Field 4D.
-00372

CH CHANGES AT NAUSET INLET, CAPE
D, MASSACHUSETTS: 1670-1981,
ds Hole Oceanographic Institution, MA.
. Speer, D. G. Aubrey, and E. Ruder.
ilable from the National Technical Information
ice, Springfield, VA 22161 as PB83-10117 0.
nical Report WHOI-82-40. August 1982. 92 p.
ig, 2 Tab, 22 Ref, 4 Append. Contract/Grant
NA 80-AA-D-00077(R/B21), DAAG29-81-K-

riptors: *Beach erosion, *Beach profiles,
s, Tidal effects, Maps, History, Cape Cod,
achusetts.

istorical study of barrier beach and inlet
ges for the Nauset Inlet region, Cape Cod,
achusetts, was performed to document pat-
of beach and inlet change as a preliminary to
ning and carrying out field studies of inlet
ent transport. One hundred twenty historical
s from 1670 and 125 sets of aerial photographs
1938 formed the basis for this study. Specific
ts of barrier beach and inlet change addressed
de onshore barrier beach movement, long-
tidal inlet migration, and longshore sand
sing past the inlet. In an effort to correlate
g events with barrier changes, an exhaustive
of the local storm climate was performed.
n induced shifts in inlet position associated
superelevated water levels are rare but signifi-
occurrences. These major inlet relocations
played an important role at Nauset Inlet by
g the inlet position to the north. Steady
ward migration characterized by flow around
d during ebb tides has occurred since 1972
a storm breach rapidly shifted the inlet loca-
The result is a steady northward migration. A
pattern of inlet migration is the growth of the
drift spit by addition of sediment from ebb
elta distal bars.
00379

MASS AND MINERAL COMPOSITION OF
ATIC MACROPHYTES IN THE HYGAM
LAND, KASHMIR WITH REFERENCE TO
TRATE NUTRIENTS,
mir Univ., Srinagar (India). Dept. of Botany.
ul.
Hydrochimica et Hydrobiologica, Vol. 12,
p 81-91, 1984. 5 Fig, 4 Tab, 29 Ref.

iptors: *Wetlands, *Hygam Wetland,
nu and Kashmir, *India, *Minerals, *Aquatic
phytes, Seasonal variation, Macrophytes, Ni-
, Phosphorus, Potassium, Sodium, Calcium,
esium, Dissolved oxygen.

Hygam wetland is situated at an altitude of
m above sea level and lies in the Kashmir
. It is a bird sanctuary with an area of 56
es. The wetland is covered by a luxuriant
h of macrophytes dominated by the associa-
of Phragmites communis, Sparganium erec-
Scirpus lacustris, and Typha angustata. Sedi-
are fine greyish, the silt and clay forming the
constituents. The geological substratum is
calcite. The studies were carried out at
sites from March 1975 to February 1976.
g six mineral constituents estimated in the
ground and below ground tissues, calcium,
en, and potassium were found in higher con-
tions. The mineral constituents show clearly
sing concentration during the season of
tion. In a regression analysis the biomasses
significant multiple regressions to concentra-
f chloride-ions, nitrogen and partly TPP and
n in the water and sediment. (Baker-IVI)
0400

RETENTION AND RELEASE OF SELECTED MAJOR AND MINOR METALS BY THE ALTAMAHA RIVER MARSH ECOSYSTEM,
Savannah State Coll., GA. School of Science and Technology.
M. P. Menon, and G. S. Ghuman.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 195-206, June, 1985. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Marshes, *Ecosystems, *Metals, *Altamaha River, *Georgia, Magnesium, Potassium, Zinc, Manganese, Plants, Nutrients, Heavy metals, Uptake.

The periodic uptake of two nutrients (major metals, K and Mg) and two heavy metals (minor metals, Zn and Mn) by two different plant species, Spartina alterniflora and S. cynosuroides that grow on different sites in the marsh islands along the terminal course of Altamaha river (Georgia) was investigated. The metal content was analyzed of the dead species and of the soil and the retention or release of the major and minor metals of each of the two ecosystems were evaluated. No significant correlation was noted between plant uptake of Mn, Zn, K, and Mg and the DTPA or ammonium acetate extractable metals of the same kind in the soil. Although there are seasonal variations in the uptake of metals by both plant communities (S. alterniflora and S. cynosuroides) the maximum occurs at different times. In general, the metal content of the dead material shows a maximum in December. The periodic retention or release behavior of the four metals for the system as a whole is also different for different metals. It appears that the salt marsh along the Altamaha river where S. cynosuroides grows releases larger amounts of Mn than the ecosystem that is populated with S. alterniflora. Zinc is retained by both systems while each of them is replenished with Mg and K annually. (Baker-IVI)
W86-00431

TURBIDITY ENHANCES FEEDING ABILITIES OF LARVAL PACIFIC HERRING, CLUPEA HARENGUS PALLASI,
Oregon State Univ., Newport. Marine Science Center.
G. W. Boehlert, and J. B. Morgan.
Hydrobiologia, Vol. 123, No. 2, p 161-170, 1985. 6 Fig, 2 Tab, 42 Ref. OWRT grant 14-34-0001-1461.

Descriptors: *Turbidity, *Herring, *Larvae, *Feeding, *Estuarine environment, Habitats, Suspended sediments, Fish behavior, Sediments, Volcanic ash, Immature growth stages.

The larvae of many species of fishes inhabit estuaries when turbidity is high, and some species prefer turbid conditions, at least as juveniles. Larval Pacific herring are able to feed at a greater rate under moderate suspensions of fine-grained sediment and volcanic ash than under clear-water control conditions. This ability decreases with increasing suspension level. Two mechanisms are suggested to account for the enhancement of feeding over controls. First, it is suggested that in the small visual field of the larvae, contrast is enhanced by the background provided by the sediment particles. Secondly, the particles scatter light in all directions, possibly resulting in greater illumination of the food particles, which in turn can decrease the transparency of the food particles. Feeding abilities of the larval herring are thus adapted to residence in the turbid estuarine environments occupied during the larval stage. (Baker-IVI)
W86-00444

FLUCTUATION IN NUTRIENTS DURING TIDAL CYCLES AT OYSTER BEDS IN THE RIVER PENZE (NORTH FINISTERE) (FLUCTUATIONS DES NUTRIMENTS AU COURS DE LA MAREE SUR LES PARCS OSTREICOLES DE LA RIVIERE PENZE (NORD-FINISTERE)),
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
G. Boucher, and R. Boucher-Rodoni.
Hydrobiologia, Vol. 123, No. 3, p 251-261, April, 1985. 5 Fig, 1 Tab, 35 Ref.

Descriptors: *Nutrients, *Tidal effects, *Oysters, *Penze, *France, *Estuarine environment, Amines, Multivariate analysis, Ammonia.

The importance of short-term fluctuations in nutrients and primary amines over oyster beds during spring and neap tidal cycles was analyzed. The range of the variations recorded over 24 h is of the same order of magnitude as that observed over an annual cycle. Multivariate analysis, taking into account all available parameters concerning the tidal cycles, showed a short-term evolution of primary amines and ammonia nitrogen, independent from that of other parameters. The latter fluctuate in synchronization with the down-and-up-stream flow of the river Penze. The mean ammonia nitrogen concentration is higher during spring tide than during neap tide, and ammonia is more concentrated at the bottom than in the surface water. This higher concentration of ammonia in bottom water is related neither to current speed, not to interstitial water dilution by sediment resuspension. Nutrient exchanges between the sediment and the water column did not seem to be an important source of ammonia, while ammonia excretion by oysters might be the main source of this nutrient at the bottom level, particularly during spring tide. (Author's abstract)
W86-00447

TIDICS - CONTROL OF TIDAL RESIDUAL CIRCULATION AND TIDAL EXCHANGE IN A CHANNEL-BASIN SYSTEM,
Kyoto Univ. (Japan). Dept. of Fisheries.
M. Kashiwai.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 1, p 1-10, February, 1985. 14 Fig, 5 Ref.

Descriptors: *Tidal currents, *Tidal exchange, *Channels, *Basins, Tidal jet, Hydraulic models, Model studies, Oscillations, Water currents, Vorticity, Bays, Tides.

A self-excited oscillation of tidal flow occurs in a tidal channel-basin system with a narrow and high speed inflowing tidal jet. The mechanism of this oscillation was examined through hydraulic experiments. Results show that the oscillation is caused by alternation in the strength of asymmetric residual circulation caused by a biased supply of vorticity by asymmetric tidal vortex pairs, and that the mechanism of alternation also depends on negative feed-back between the residual circulation and the vorticity supply. The unstable state of the flow suggested the possibility of controlling the tidal current and tidal exchange in the channel-basin system and this was confirmed experimentally. Under fixed tidal conditions and with fixed basin dimensions, the tidal residual circulation was controlled to form two strong clockwise and anticlockwise circulations or a single circulation by changing the shape of the bay entrance. (Author's abstract)
W86-00448

HYDRAULIC EXPERIMENT ON TIDAL EXCHANGE,
Kyoto Univ. (Japan). Dept. of Fisheries.
M. Kashiwai.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 1, p 11-24, February, 1985. 12 Fig, 6 Tab, 13 Ref.

Descriptors: *Tidal exchange, *Tidal currents, Hydraulic models, Water currents, Bays, Channels, Mixing, Model studies.

Tidal exchange through a narrow entrance channel was studied experimentally with the use of a simplified hydraulic model. The inflowing water mass, visualized with dye solution, exhibits the shape of a starting plume with a starting vortex pair at its head. Because of their periodical formation by the tide, these are called the 'tidal plume' and 'tidal vortex pair'. The axis of the tidal plume deflects and undulates with a period 2 to 9 times that of the tide. Together with this undulation, the vortex pair becomes asymmetric. A circulating flow is formed in the bay which affects the shape of the inflowing

and outflowing water masses. A part of the inflowing water mass flows out during the subsequent ebb, and this outflowing portion can be divided into two parts. One is the water remaining in the entrance channel at high water which flows out during the first half of the subsequent ebb and the other is the water flowing round the bay in the circulating flow during flood that flows out during the latter half of the subsequent ebb. Both contribute to the exchange ratio, but one can estimate an upper limit for the exchange ratio by neglecting the latter outflow. This neglected portion is considered in the concept of the age composition of outflowing water. The age composition of the bay water shows the existence of intermittent effluence superposed on a trend in the age composition that is similar to that of the well-mixed case. From the analysis of a model consisting of a number of mixing tanks connected in series with a recycle flow, it is concluded that this intermittent effluence occurs in the case of weak mixing due to the effect of circulating flow in the bay but is negligible in the case of strong mixing. (Author's abstract)
W86-00449

OBSERVATIONS OF INTERNAL TIDES IN UCHIURA BAY,
Tokyo Univ. of Fisheries (Japan).
M. Matsuyama, and T. Teramoto.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 1, p 39-48, February, 1985. 9 Fig, 8 Tab, 9 Ref.

Descriptors: *Tidal currents, *Internal tides, *Uchiura Bay, *Japan, Thermocline, Thermal stratification, Oscillation, Standing waves.

Remarkable tidal currents associated with temperature fluctuations in the subsurface layer has been observed in Uchiura Bay. In order to study the characteristics of these tidal currents, current measurements were carried out in November 1972 and October 1974. It was confirmed from the first set of observations in 1972 that the tidal currents above and below the seasonal thermocline oscillate out of phase with each other and the tidal currents are associated with internal tides. In the second set of observations in 1974 not only current measurements but also serial BT lowerings were made. The phase of the thermocline displacements lagged behind the tidal currents by 81 degrees for the semidiurnal constituent and by 83 degrees for the diurnal constituent, and it is thus concluded that the internal tides in Uchiura Bay behave as standing waves. (Author's abstract)
W86-00450

IN SITU MEASUREMENT OF OXYGEN CONSUMPTION RATE IN THE BOTTOM LAYER IN MIKAWA BAY,
Institute of Physical and Chemical Research, Saitama (Japan).
S. Unoki, Y. Saijo, and S. Tawara.
Journal of the Oceanographical Society of Japan, Vol. 41, p 59-62, 1985. 3 Fig, 4 Ref.

Descriptors: *Mikawa Bay, *Japan, *Oxygen consumption, *Eutrophication, *Tidal waters, Salinity, Dissolved oxygen, Water temperature, Water currents, Wind.

Direct estimation of the oxygen consumption rate in the bottom layer of Mikawa Bay (Japan) where eutrophication is in progress was attempted using in situ continuous measurement of oxygen content and other oceanographic parameters. The ten parameters studied included water temperature, salinity, current velocity and direction, and dissolved oxygen. A change was noted in dissolved oxygen concentration from 21 to 25 July 1974. A gradual decrease in oxygen in the deeper layer was noted from 22 July to early morning of 25 July, with some fluctuations which can possibly be attributed to tidal motion. This gradual change was interrupted at 4 am on the 25th by a strong wind which arose on the afternoon of the 24th. The oxygen content in the deeper layer increased suddenly, and the difference in water temperature between the upper and lower layer diminished. An abrupt decrease in salinity in the lower layer at this time suggests mixing of the upper and lower waters. Data suggest that a water mass, in which the temperature and the salinity differ lateraly depending on the ratio of mixing, moves in and out with the tide. It is surmised that at the buoy location the bottom water was stagnant during this period even though it underwent tidal movement. (Baker-IVI)
W86-00451

HEAVY METAL CONTENT OF OYSTER, BLUE MUSSEL AND GROWING WATER IN HANSAN-GEOJE BAY (IN KOREAN),
Fisheries Research an Development Agency, Pusan (Republic of Korea).
For primary bibliographic entry see Field 5C.
W86-00454

MEIOFAUNA ASSOCIATED WITH MANGROVES IN THE HUNTER RIVER ESTUARY AND FULLERTON COVE, SOUTH-EASTERN AUSTRALIA,
Australian National Univ., Canberra. Dept. of Zoology.
M. Hodda, and W. L. Nicholas.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 41-50, 1985. 2 Fig, 5 Tab, 21 Ref.

Descriptors: *Invertebrates, *Mangroves, *Hunter River Estuary, *Fullerton Cove, *Australia, Estuarine environment, Water pollution effects, Salinity, Particle size, Elevation, Copepods, Nematodes, Oligochaetes.

The Hunter River estuary and adjacent Fullerton Cove (Australia) were chosen for this study, partly because of the extensive stands of a single species of mangrove, Avicennia marina, that occur there and partly because of the range of estuarine conditions present, some of which include industrial pollution. The meiofauna from 14 sampling sites around the Hunter River estuary is described, and the factors influencing total density and relative abundance of nematodes and copepods and some species distributions are discussed. Elevation above low tide mark influenced nematode density, and salinity influenced copepod density and relative abundance. Both nematodes and copepods were most dense near the mud surface, and algal food and the depth of the reducing layer appear to be partially responsible for major differences in the density of these two taxa at different sites. Pollution also influenced the total density of both nematodes and copepods and also the relative abundance of oligochaetes. There was a lack of any statistically significant relationship between the median grain size and either the relative abundance of nematides or copepods or the ratio of nematodes to copepods; pollution or substantial differences in trophic dynamics of the fauna may obscure the relationship. (Moore-IVI)
W86-00521

SEDIMENTATION OF PARTICULATE MATERIAL IN NORDASVANNET, A HYPERTROPHIC, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
P. Wassmann.
Marine Ecology - Progress Series, Vol. 22, No. 3, p 259-271, March, 1985. 7 Fig, 2 Tab, 51 Ref.

Descriptors: *Fjord, *Sedimentation, *Nordasvannet, *Norway, Particulate matter, Wastewater pollution, Seasonal variation, Mineralization, Phosphorus, Chlorophyll a, Biomass, Phytoplankton.

Sedimentation of particulate material to the sea bottom (90 m) was measured in Nordasvannet, a land-locked, highly stratified, west-Norwegian fjord, receiving fresh water from a small glacier-free watershed and untreated domestic sewage from 30,000 persons equivalents. Five cylindrical sediment traps positioned 20, 40, 45, 50, and 65 m below the water surface were deployed from March 1982 to April 1983. Variability of seasonal sedimentation rates was small, especially at greater depths. Sedimentation rates of total particulate material and particulate organic carbon decreased from 594 and 83 at 20 m, to 389 and 58 g/sq m/yr, respectively, in deeper water. Possible reasons for decreasing sedimentation with increasing de mineralization in the water column and l resuspension in deeper water. However se tation rates of particulate total phosphor chlorophyll a equivalents increased betw and 45 m depth. These conflicting result interpreted as a possible consequence of lower catchment efficiencies of the upp traps and artificial mineralization inside the No evidence was found for sedimentatio sponses on time variations of suspended b yet larger parts of the biomass of the spring plankton bloom settled to the seafloor of vannet. Besides fecal pellets few recog structures were found in the traps. The PO tent of the deposited material was high co to results given in literature and comprise 21%. It is hypothesized that a large and con allochthonous supply of nutrients to Norda equalizes both primary production and its s tation. (Author's abstract)
W86-00527

MINERAL SALTS AND TIDAL CYCLES ESTUARY IN NORTH BRITTANY (DUFF, FRANCE) (SELS MINERAU CYCLES DE MAREES DANS UN EST DE BRETAGNE NORD (DOUE FRANCE)),
Centre d'Etudes d'Oceanographie et de Marine, Roscoff (France).
C. Riaux-Gobin.
Hydrobiologia, Vol. 124, No. 1, p 35-4 1985. 6 Fig, 2 Tab, 26 Ref.

Descriptors: *Nutrients, *Tides, *E *Dourduff, *France, Ammonium, Nitra trites, Silicon dioxide, Phosphates, Rive Seston, Resuspension, Seasonal variation.

Short-term variations in nutrient concentra water-masses have been studied in a Britta ary over several tidal cycles, during wi summer. NH4(+), NO2(-), NO3(-), Si PO4(3-) have been measured at a fixed stat Dourduff estuary (France) is characteriz very low river discharge (80 l/s during t mum water runoff and 1 000 l/s during t mum) and an important tidal range (9 m tides). SiO2 and NO3(-) concentrations are related to freshwater flow whereas PO4(3 tially adsorbed by seston in the turbid ebb NH4(+) concentration seems to be, in pendent upon sediment resuspension: late onset of flood periods liberate NH4(+) overlying water column. Nutrient conce are also related to seasons. Nutrient fl insignificant or negative during summer pe the estuary imports nutrients for its own r whereas during winter periods is export and SiO2 (ca 50 kg NO3(-) and ca 200 during a single spring tide). The NO3:PO always above 15:1 and can reach 300:1; r this ratio fluctuates during the tidal cy imbalances originates in terrestrial disch nitrogen compounds. (Author's abstract)
W86-00530

RELATIONSHIP OF CELLULAR PH RUS IN THE CYANOBACTERIUM LARIA TO PHOSPHORUS AVAILABI THE PEEL-HARVEY ESTUARINE SYS
Western Australia Univ., Nederlands. Ins riculture.
K. S. Hamel, and A. L. Huber.
Hydrobiologia, Vol. 124, No. 1, p 57- 1985. 4 Fig, 2 Tab, 22 Ref.

Descriptors: *Estuarine environment, * rus, *Nodularia, *Peel-Harvey Estuarine *Western Australia, Cyanophyta, Eutro Water pollution sources, Limiting nutri cling nutrients.

A laboratory-determined 'critical concen phosphorus in the cyanobacterium Nodu migena was used to assess the phospho ciency of field populations in the Peel-H tuarine System, Western Australia. Nutr tion bioassays indicated that phosphoru

g nutrient. Since river flow, and thus phos-
s input, to the estuary ceases 1-2 months
the onset of Nodularia blooms, the phos-
s contained in these blooms was derived
ediment release and nutrient recycling. A
ssive increase in the mean cellular phospho-
ncentration of Nodularia from 1981 to 1983
ed that sediments were releasing a greater
t of phosphorus each year. Although evi-
suggests that the biomass of recent Nodu-
ooms is now limited by physical factors, the
nal phosphorus contained in each bloom
crease the supply of phosphorus to other
ms. Cellular phosphorus concentrations in
aria appeared to be correlated with river
orus loadings in the Peel Inlet but not in the
Estuary. (Author's abstract)
0531

STICAL MODELING OF HISTORIC
E EROSION RATES ON THE CHESA-
E BAY IN MARYLAND,
Academy, Annapolis, MD. Dept. of Mathe-

mary bibliographic entry see Field 2J.
0556

JATION OF THE RELEVANCE OF
ENVIRONMENTAL FACTORS TO THE
ATION OF MIGRATORY TIMING AND
FOR THE BROWN SHRIMP OF PAM-
OUND, NORTH CAROLINA,
ominion Univ., Norfolk, VA. Dept. of
graphy.
Matylewich, and P. R. Mundy.
American Journal of Fisheries Management,
No. 2A, p 197-209, Spring, 1985. 4 Fig, 9
Ref.

tors: *Shrimp, *Migration, *Pamlico
*North Carolina, *Mathematical models,
emperature, Salinity, Air temperature, Pre-
n, River discharge, Shellfish, Prediction,.

rized logistic model and a multiple linear
vere used to relate environmental factors
umber, water temperature, salinity, air tem-
, precipitation, net heating degree days,
scharge) to the time distribution of the
ve proportion of catch and catch per unit
the brown shrimp (Penaeus aztecus), re-
y. Multiple regression analysis yielded
s containing the week number, the water
ure, and an interaction term as the inde-
variables. Predictions of total annual yield
l annual catch per unit effort are made
e migratory time density approach. The
ctor, represented by weeks numbered
ut the year, contributes the most in ex-
the variation in the migratory timing.
for predicting migratory behavior and
the brown shrimp should consider water
ure to be a significant factor. Although
els are not statistically precise, the empiri-
ictions are an improvement over existing
s. (Author's abstract)
89

ICAL MODEL FOR TIDAL CURRENT
CHANGJIANG RIVER ESTUARY,
Hydraulic Research Inst. (China).

gia et Limnologia Sinica, Vol. 16, No. 1,
985. 10 Fig, 4 Ref.

ors: *Mathematical models, *Tidal cur-
hangjiang River Estuary, Estuaries, Eddy
Boundary conditions, Costs.

er presents a generalized finite difference
or the solution of the two-dimensional
equations expressed as being integrated
vertical. In this paper the Changjiang
tuary is simulated in order to investigate
tiveness of the method on tidal current.
putational results agree well with the tidal
ield survey data. Plane domain is sup-
consist of triangular elements of weakly
e. Partial derivatives of order 1 and 2 are
t nodal points. In the basic equations of tidal current horizontal eddy viscosity term is also considered. This method has a great advantage of having the flexibility to express the configuration. That is, the boundary configuration of the model is more accurate, and an interested area of the computation by the method can be divided into any small elements arbitarily. Moreover, the computational cost of this method is cheaper. (Author's abstract)
W86-00601

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

COMBINED HYDROMETEOR DISTRIBUTIONS FROM THREE PMS PROBES,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
G. L. Gordon.
IN: Cloud Physics in the SCPP: Interim Progress Report, 1983-84, December 29, 1984. p 53-85, 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Measuring instruments, *Cloud physics, *Precipitation, *Lasers, Hydrometeor distribution, Sierra Nevadas, Meteorological data collections, Ice.

The combined hydrometeor distributions observed by three optical array probes are described. The total hydrometeor distribution can be partitioned into several regions of exponential distributions, each having its own slope and intercept. The different exponential regions are probably the result of different growth characteristics occurring at those particular sizes. Use of a single probe is not sufficient for determining total hydrometeor distributions. The overlapping sizes between the probes can be used to eliminate the size bins that have measurement problems, thus producing a spectrum with more valid numbers. In regions of secondary ice crystal production and when there are sufficient large particles, the hydrometeor spectrum can be represented by a single parameter distribution.
W86-00308

GROSSVERSUCH IV: 'EXTENDED AREA' EFFECTS ON RAINFALL,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
H. H. Schiesser.
Journal of Climate and Applied Meteorology, Vol. 24, No. 3, p 236-252, March, 1985. 15 Fig, 5 Tab, 14 Ref.

Descriptors: *Cloud seeding, *Rainfall, *Hail suppression, Switzerland, Weather modification, Statistical analysis.

Grossversuch IV, the Swiss randomized hail suppression experiment, was designed to test the hypothesis that seeding hail clouds, according to the beneficial competition concept, would decrease the hail kinetic energy. Two different networks of raingages were used to analyze 37 seed and 50 noseed days for possible seeding effects on rainfall during the hail suppression experiment in Switzerland. 'Moving grid' analyses within a range of 100 km of the seeding center showed no statistical evidence of a seeding effect for 24 h-values. For the experimental unit (9 h), and area 'upwind' (with respect to the mean wind direction) of the target showed a statistically significant increase in rainfall of 118% on seed days, although no 'upwind' effect should be expected. Four heavier rainfalls dominate the seed ensemble and are responsible for that effect. But on those days the environmental wind directions and the movements of the single cells (seeded) point in the opposite direction of the 'upwind' area. Despite randomization, the effect must be mainly due to natural variability. Thus other effects in the target or 'downwind' must likewise be regarded as random. There may be a small seeding effect, especially in a shorter time interval. (Moore-IVI)
W86-00424

3F. Conservation In Agriculture

ROW SPACING, PLANT POPULATION, AND WATER MANAGEMENT EFFECTS ON CORN IN THE ATLANTIC COASTAL PLAIN,
Agricultural Research Service, Florence, SC.
D. L. Karlen, and C. R. Camp.
Agronomy Journal, Vol. 77, No. 3, p 393-398, May-June, 1985. 6 Tab, 35 Ref.

Descriptors: *Corn, *Row spacing, *Plant population, *Irrigation scheduling, Water management, Water stress, Fertilizers, Soil water, Crop yield, Computers, Soil water potential.

Lack of water because of erratic rainfall frequently limits corn (Zea mays L.) production of Typic Paleudults in the Atlantic Coastal Plain. Traditionally, wide (96 cm) row spacing and low plant population have been used to prevent water stress, but recently landowners have begun to invest in irrigation systems. Changes in row spacing, plant population, or fertilization practices may be required to achieve maximum water- and nutrient-use efficiency with those systems. Plant population treatments averaging 7.0 and 10.1 plants/sq m in single and twin rows were investigated on a Norfolk (fine-loamy, siliceous, thermic Typic Paleudult) loamy sand during 1980, 1981, and 1982. Three water management (nonirrigated, irrigated using tensiometers (TENS) to measure soil-water potential for scheduling, and irrigated using a computer-based water balance (CBWB) for scheduling), and two fertilization programs were also evaluated in a four-factor split-plot design. Water management and plant population interacted significantly. Planting in twin rows increased grain yield an average of 0.64 Mg/ha (10 bu/A), but planting more than 7.1 plants/sq m significantly increased grain yield only in 1980. Irrigation increased grain yield 150, 161, and 8% in 1980, 1981, and 1982, respectively, as a result of increased kernal weight and number of kernals per ear. Increasing total N, P, and K application beyond 200, 30, and 167 kg/ha, respectively, did not significantly influence grain yield or yield components. Yield advantages of narrow rows can be obtained on Coastal Plain soil which require subsoiling by using a twin-row planting configuration. Irrigation can be scheduled using either tensiometers (soil-water potential) or a computerized water balance without significantly changing corn grain yield, nutrient accumulation, or yield components. (Author's abstract)
W86-00460

PHYSIOLOGICAL RESPONSE OF MEADOWFOAM TO CROP WATER DEFICITS,
Colorado State Univ., Grand Junction. Fruita Research Center.
C. H. Pearson, and G. D. Jolliff.
Agronomy Journal, Vol. 77, No. 3, p 422-426, May-June, 1985. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Meadowfoam, *Oilseed crops, *Water deficit, Water stress, Irrigation effects, Transpiration, Canopy temperature, Plant water potential, Osmotic potential, Turgor, Stomatal resistance.

The new oilseed crop, meadowfoam (Limnanthes alba), is adapted to wet meadows in its native habitat. The plant has been domesticated and commericalized. Plant water stress during seed development may be a cause of seed yield variation in cultivated fields. A field study was conducted to characterize meadowfoam response to water stress. Treatments included: no irrigation (control); early irrigation, during May (EI); and continued irrigation, from the 1st week of May until crop maturity (CI). Treatments were applied in a randomized complete block experimental design in 1981 and 1982. Plant water potential, turgor potential, osmotic potential, stomatal resistance, transpiration, and canopy temperature were measured at 0600, 0900, 1200, 1500, and 1800 h on several days during flowering and seed development. Generally, crop water deficits were greatest and transpiration was highest at 1500 h, and stomatal resistance

was highest in 1800 h. Meadowfoam maintained an unusually high water potential which did not drop below - 0.8 MPa. The amount of precipitation during flowering in 1982 was the lowest in 16 years. At mid-flowering after 1200 h the control plants had higher crop water deficits, higher stomatal resistance, lower transpiration, and slightly higher canopy temperature than the irrigated plants. The responses became progressively greater by late flowering and early seed fill. Crop water stress in the EI treatment was slight at mid-and late flowering, but because greater at early seed fill. Adaptation of meadowfoam to crop water stress by lowering osmotic potential was minimal. Canopy temperatures of the EI treatment at early seed fill averaged 0.8 C higher than the CI treatment. Meadowfoam requires a high water potential for growth and development, and its tolerance to crop water deficits is low. Stomata of meadowfoam close at relatively high plant water potentials. (Moore-IVI)
W86-00461

SUBIRRIGATION SYSTEM CONTROL FOR WATER USE EFFICIENCY,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
M. C. Smith, R. W. Skaggs, and J. E. Parsons.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 489-496, March/April, 1985. 13 Fig, 4 Tab, 12 Ref.

Descriptors: *Irrigation, *Water requirements, Irrigation requirements, *Water conservation, Subsurface irrigation, Simulation, Water table, Mathematical equations, Boussinesq equation.

An evaluation was made of water requirements of subirrigation under three methods of system control through both a field experiment and the use of computer simulation analysis. Field experiment results indicate that irrigation water requirements can be reduced by controlling the system such that the midpoint water table depth is allowed to fluctuate within certain limits. The simulation model was based on numerical solutions to the Boussinesq equation and was developed to allow comparison to be made between the control methods using historical weather records. Several simulations were conducted for each control method to optimize the set points for starting and stopping subirrigation for the given method. Using the optimum set points, the simulations pedicted a decreased irrigation requirement when the midpoint water table depth was allowed to fluctuate. The irrigation requirement was decreased by an average of 6.7% over constant water level control for five years of simulations. Much larger differences could have occurred had the set points not been optimized. There is potentially more difference in irrigation water requirements for different set points within a given control method than between two different control methods. There is a good potential for reducing irrigation requirements of subirrigation by using a simple control system employing a float switch triggered byth field water level. A slight modification in the way in which subirrigation systems are currently controlled can result in decreased water usage. (Baker-IVI)
W86-00473

THREE-DIMENSIONAL INFILTRATION AND TRICKLE IRRIGATION,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
B. Clothier, D. Scotter, and E. Harper.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 497-501, March/April, 1985. 5 Fig, 12 Ref.

Descriptors: *Soil water, *Trickle irrigation, *Infiltration, Flow, Permeability, Soil properties, Irrigation pattern.

The movement of water into the soil under a trickle emitter occurs in response to equi-dimensional capillary attraction and downward movement as a result of gravity. Soil texture, or more specifically soil pore geometry, determines the relative importance of gravity and capillary forces. The distribution of irrigation water from a drip emitter is dominated by the physical properties of the soil. In some cases the hydraulic properties of soil can be so variable in time and space as to negate the utility of detailed theoretical analyses. Efficient operation of trickle irrigation relies on the ability of the soil to transport the water away from the dripper into the root zone. Soil cracks, biopores and other preferential water flow pathways can act to subvert the uniform distribution of water. Economic returns from horticulture are often sufficient to allow for more elegant engineering design to eliminate the reliance on the soil as a distribution medium. Microjets, minisprinklers and sprinklers are options on such soils. These devices, in contrast to drippers, spread the water out over the soil surface. Minisprinklers can apply water at such a rate (flux density) as to prevent the formation of a surface free water pond. This irrigation water will then infiltrate the soil via smaller pores giving a more uniform wetting patern. The large pores which can only be accessed by free water, remain air-filled. Therefore the wetting of any portion of the root zone is a simple matter of minisprinkler engineering design, divorced from the confounding influence of the soil. (Baker-IVI)
W86-00474

FURROW COMPACTION FOR CONTROLLING EXCESSIVE IRRIGATION WATER INTAKE,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
J. T. Musick, F. B. Pringle, and P. N. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 502-506, March/April, 1985. 3 Fig, 4 Tab, 18 Ref.

Descriptors: *Irrigation practices, *Soil compaction, *Furrow compaction, Soil properties, Compaction, Irrigation, Soil water, Corn.

The results of testing the irrigation of SOFT and HARD furrow treatments for corn production are compared with a conventional control treatment of every-furrow (EF) irrigation. The EF treatment had alternating pairs of HARD and SOFT furrows. Soil bulk densities were evaluated below the soil surface in irrigated furrows. Also evaluated were irrigation water application, intake, surface runoff, soil water storage, estimated profile drainage, evapotranspiration, and corn yields. The field study was conducted on Olton clay loam which is a fine, mixed thermic family of Aridic Paleustolls. Wide spacing of furrows had very little effect, while wheel compaction reduced the average water intake during seasonal irrigation from 123 to 82 mm and estimated profile drainage losses from 29.4 to 9.1% of water applied. Tractor-wheel compaction from multiple field operations increased average dry soil bulk densities from 1.26 to 1.62 Mg/cubic m. Irrigated furrows were compacted as a separate tractor pass prior to the preplant irrigation, and effects remained throughout the growing season. The reduced water intake with furrow compaction did not affect corn grain yields. Alternating compacted and noncompacted furrows permits flexibility in irrigating for a range in water intake, depending on water use rates and profile soil water depletion. Irrigation of compacted furrows permits the use of a fixed pumping rate to irrigate a larger area by reducing profile drainage and increasing field application efficiency. (Baker-IVI)
W86-00475

BANANA YIELD AS AFFECTED BY DEFICIT IRRIGATION AND PATTERN OF LATERAL LAYOUTS,
Hawaii Univ. at Manoa, Honolulu. Dept. of Agricultural Engineering.
S. C. H. Young, T. W. Sammis, and I.-P. Wu.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 507-510 and 516, March/April, 1985. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Irrigation practices, *Bananas, *Crop yields, *Drip irrigation, Deficit irrigation, Soil water, Evapotranspiration, Clay, Soil properties.

The water requirement of the banana plant for optimum growth and fruit production was determined and the effect of evapotranspiratio
yield of deficit irrigation were also consi
The response of the banana plant to differen
ting patterns formed by placing drip irri
laterals at selected locations away from th
was also investigated. Yield and evapotransp
increased, as described by a linear relationsh
to the maximum application rate of 1.8 x pa
effective rainfall (annual effective rainfall
mm). The evapotranspiration associated wi
maximum treatment was 2613 mm/year re
in a yield of 126 t/ha averaged over two
which was considerably higher than the ma
reported yields in the literature of 50 to 6
Daily application of irrigation water using
irrigation system which maintains the soil m
in a portion of the root zone near field capac
double banana yields. The location of th
system in relationship to the banana mat was
tically not significant. (Baker-IVI)
W86-00476

**DROPLET SIZE DISTRIBUTION AND W
APPLICATION WITH LOW-PRES
SPRINKLERS,**
Wuhan Inst. of Hydraulic and Electric Pow
gineering (China).
D. Chen, and W. W. Wallender.
Transactions of the American Society of A
tural Engineers, Vol. 28, No. 2, p 511-516,
April, 1985. 9 Fig, 2 Tab, 14 Ref.

Descriptors: *Irrigation practices, *Water d
tion, *Sprinkler irrigation, Nozzles, Dro
Cost analysis, Spacing.

The interpretation of droplet size distributi
water distribution were enhanced over a r
operating pressures for noncircular nozzles
let sizes and water application uniform
square, double rectangular, and triangular
were compared with the performance of
nozzles of similar discharge characteristics.
ally, volume weighted mean droplet size
larger for noncircular nozzles at a given
from the sprinkler but circular nozzles pr
the largest average droplet size at the outer
eter of their pattern. This was possible bec
circular nozzles projected the water farth
their noncircular comparison nozzles. T
damage hazard due to large droplets was
compounded by the high water applicati
near the perimeter (doughnut pattern), for
nozzles operated at low pressures. Square
angular nozzles produced doughnut shap
terns only at the lowest pressure tested, 138
psi). Cost analysis gave the cost-pressure
needed as input to the sprinkler selection ar
ing decision process. Costs for the noncirc
circular nozzle cases were comparable. M
cost sprinkler spacing along the lateral wa
equal to spacing along the mainline for l
sure nozzles while for circular nozzles,
spacing was a third to a half of mainline
Mainline spacing was less for low-pressur
klers, therefore if a retrofit is proposed
spacing of lateral lines along the mainlin
vised. (Baker-IVI)
W86-00477

**INFILTRATION UNDER SURGE I
TION,**
Everglades Research and Education Cent
Glade.
F. T. Izuno, T. H. Podmore, and H. R. Du
Transactions of the American Society of
tural Engineers, Vol. 28, No. 2, p 517-521,
April, 1985. 5 Fig, 3 Tab, 11 Ref.

Descriptors: *Surge irrigation, *Infiltrati
water, Infiltrometers, Irrigation practices
tion, Furrow irrigation, Wetting.

Surge irrigation advance studies were con
the field to illustrate the relationships bet
surge infiltration phenomenon and the co
ing accelerated surge advance rates.
furrow infiltrometer studies in the field w
ducted on both surge and continuously
furrows to quantify the reduction in in

es caused by surged applications. The surge gation infiltration phenomenon and its ability to ble the surge benefits to exist was explored. hough surge and continuous infiltration rates numerically equivalent, a step drop from the n time dependent infiltration rate to the basic after one complete surge cycle is the apparent se of the accelerated advance rates observed er surge irrigation. The step drop in surge tration rates results in smaller volumes of ap- d water required for advance when surge irri- on is used compared to continuous applica- s. The reduced infiltration phenomenon under ge irrigation appears not to undergo further ction with subsequent surges of an irrigation. phenomenon does not appear to be cumulative n successive irrigations of a season. Because of relationship between infiltration rates and ad- ce, surge irrigation reduces differences in rate dvance between furrows with different levels ompaction. Surge irrigation also reduces ad- ce rate differences caused by repeated irriga- s of a furrow. It appears that seasonal and paction infiltration effects on advance can be ced by maintaining surge cycle on times below time where continuous advance curves begin eflect infiltration differences. Three distinct es of infiltration occur under surged furrow ation. These phases are infiltration into initially soil, infiltration into previously wetted soil, a transition infiltration regime caused by in- ed wetted perimeters occurring after the first ing of a furrow section. (Baker-IVI)
-00478

-PLOT FOR DRIP IRRIGATION LATERAL SUBMAIN DESIGN,
aii Univ. at Manoa, Honolulu. Dept. of Agri- ral Engineering.
Wu.
sactions of the American Society of Agricul- Engineers, Vol. 28, No. 2, p 522-528, March/ , 1985. 11 Fig, 1 Tab, 12 Ref.

riptors: *Drip irrigation, *Design criteria, *Ir- on, Irrigation practices, Infiltration, Hydrau- sign.

i-plot is presented for drip irrigation lateral submain design which applies the polyplot ept by plotting the energy gradient line and dimensionlessly. The uni-plot concept pro- a simple design procedure for lateral and ain design for either uniform or non-uniform situations. The pressure variation along a l line or a submain is determined by balancing ergy drop by friction and the energy gain (or due to slopes. For the concept of Poly-plot ference area can be made by using an allow- ressure variation and either the slope profile energy gradient line (EGL). The allowable re variation is defined as the difference be- maximum pressure and minimum pressure in e which is determined based on the operat- ressure and a design criterion of pressure ion expressed as a percentage. The EGL for le-size lateral or submain is a curve and the for a multi-size lateral or submain can be ximated by a straight line. By applying the pt of poly-plot and plotting the length and terms dimensionlessly, two uniplots were ped for lateral (or submain) design for a size or multiple sizes. The uni-plot can be or both uniform and non-uniform slope situa- nd used for checking the acceptability of a or to design a lateral (or submain) size based esign criterion. (Baker-IVI)
0479

OW FIRMING FOR CONTROL OF IRRI- ON ADVANCE RATES,
ing Univ., Laramie. Dept. of Agricultural eering.
Fornstrom, J. A. Michel, Jr., J. Borrelli, and Jackson.
ctions of the American Society of Agricul- Engineers, Vol. 28, No. 2, p 529-531 and 536, /April, 1985. 2 Fig, 3 Tab, 9 Ref.

ptors: *Furrow irrigation, *Advance rate, w compaction, Crops, Compaction, Soil ction, No-till, Tillage.

An attempt was made to design, build and evaluate a tool which would increase the advance rate of irrigation water in no-till and conventionally tilled furrows. The specific design objectives of the tool were that it should reshape and compact the furrow as well as clear previous crop residue from the no-till furrows. The unit constructed to reshape and compact the furrows consisted of a furrow forming tool and a firming unit for each furrow mounted on a 3 point hitch toolbar. The firming unit consisted of 35 cm diameter V-shaped wheels, hinge mounted with a frame such that suitcase tractor weights could be attached to each row unit. The unit was evaluated by comparing water advance distances in firmed and unfirmed irrigation furrows with the same irrigation flow rates. Tests indicated improved advance rates for both no-till and conventionally tilled plots. Twice the advance distance was obtained in no-till plots when the firming unit with 144 kg of additional weight was used and approximately 40% more in conventionally tilled plots. Water advance distance, in no-till furrows after firming, approached those of the conventionally tilled furrows before firming. Soil cone index values obtained from penetrometer tests indicate that some compaction was obtained to a depth of 10 cm with a weighted firming wheel. A consistent increase in cone index for corrugated and firmed treatments (without weights) was not obtained. Thus the firming device was successful in improving irrigation water advance rates and uniformity of advance. Probable benefits of increased advance rates include reduction in leaching of fertilizers and pesticides and possible reduced soil erosion since smaller furrow flow rates can be used. (Baker-IVI)
W86-00480

SURGE FLOW BORDER IRRIGATION USING AN AUTOMATIC DROP GATE,
Alexandria Univ. (Egypt). Dept. of Agricultural Engineering.
S. M. Ismail, G. L. Westesen, and W. E. Larsen.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 532-536, March/April, 1985. 7 Fig, 6 Ref.

Descriptors: *Border irrigation, *Surge flow, *Gates, Drop gates, Design criteria, Irrigation efficiency, Irrigation practices, Automation.

Surge flow with border irrigation varies from that done with furrows because the outflow rate varies. One device used to control water in this fashion is an automatic drop gate. The gate has several advantages. It opens and closes automatically. The gate can be designed to utilize any available head between the reservoir water surface and the land irrigated. The head ditch can be used as a reservoir. No electronic system or timer is needed to control the cycle. Minimal management is required. The gate is easily designed and economically fabricated. Field experiments were conducted to evaluate border irrigation systems using surge flow and the automatic drop gate and compare surge flow with conventional continuous flow. Surge flow border irrigation resulted in better irrigation efficiency than continuous flow. The automatic surge flow gate that was developed performed as designed and showed the potential for automatic control. The design procedure developed can be used for different flow rate and border sizes. (Baker-IVI)
W86-00481

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

USE OF VEGETATION IN DELINEATING WETLAND BORDERS IN UPPER MISSOURI RIVER BASIN; NORTH-CENTRAL UNITED STATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.

For primary bibliographic entry see Field 2H.
W86-00359

SELF-CLEANING, NON-POWERED TRASH SCREENS FOR SMALL IRRIGATION FLOWS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
J. A. Bondurant, and W. D. Kemper.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 113-117, January/February, 1985. 9 Fig, 4 Ref.

Descriptors: *Irrigation canals, *Trash screens, *Maintenance, Weed control, Screens.

Material found in irrigation water which will plug a siphon tube or a gated pipe outlet is collectively called trash. Included are live and dead plant material, fish, snails, worms, insects, aquatic plants, moss, algae, and miscellaneous materials such as plastics and aluminum cans. Three different self-cleaning trash screen configurations are described: the horizontal rectangular screen; the circular, center fed turbulent fountain screen; and an in-stream, submerged screen. The mode of operation to remove trash, screen construction and field test results are presented. Flat trash screens consisting of a frame, a support screen, and a final screen have been found to satisfactorily remove trash and some weed seeds from irrigation flows. These screens are essentially self cleaning if designed correctly. At least 0.20 m (8 in.) of head is usually required for self cleaning operation of either the rectangular screens or the turbulent fountain, center-fed screen. More head is desirable to create adequate turbulence but turbulence can be created using vortex shedding techniques. Most types of trash which come through a turnout can be removed if adequate head is available. An in-stream type trash screen was designed which operated successfully in a stream containing large amounts of pondweed. (Baker-IVI)
W86-00490

EFFECTS OF ARTIFICAL DRAINAGE ON SOIL MINERAL NITROGEN DYNAMICS IN WINTER WHEAT ON THE SOUTHERN PIEDMONT,
Georgia Univ., Athens. Inst. of Ecology.
P. M. Groffman, J. E. Box, Jr., and R. L. Todd.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 9, p 1051-1063, August, 1984. 6 Tab, 18 Ref.

Descriptors: *Drainage effects, *Soil chemistry, *Nitrogen, *Wheat, Subsurface drainage, Mineralization, Nitrification, Crop yield, Fertilizers.

Excess soil moisture is believed to cause reduced levels of soil mineral N and crop production in winter wheat on the Southern Piedmont. Artificial subsurface drainage was used to relieve excess soil moisture and soil mineral N levels, mineralization, nitrification, denitrification and a group of soil properties were analyzed in both drained and undrained treatments. Drainage increased rates of mineralization and nitrification and decreased rates of denitrification, leading to higher levels of soil mineral N in drained plots than in undrained plots. Wheat yields were not affected by drainage, probably because the rate of N applied in spring (80 kg-N/ha) was high enough to counteract the effects of decreased soil mineral N levels in undrained treatments. (Author's abstract)
W86-00513

4B. Groundwater Management

GROUNDWATER DEVELOPMENT, KHARGA OASES, WESTERN DESERT OF EGYPT: A LONG-TERM ENVIRONMENTAL CONCERN,
La Moreaux (P.E.) and Associates, Inc., Tuscaloosa, AL.
P. E. LaMoreaux, B. A. Memon, and H. Idris.
Environmental Geology and Water Science, Vol. 7, No. 3, p 129-149, 1985. 20 Fig, 3 Tab, 139 Ref.

Descriptors: *Groundwater management, *Water resources development, *Egypt, Groundwater po-

tential, Wells, Artesian wells, Deserts, Hydrogeology, Water quality.

The groundwater reserves in Kharga Oases have been studied for the long-term socioeconomic development in the area. The Nubian Sandstone, which consists of a thick sequence of coarse clastic sediments of sandstone, sandy clay interbedded with shale, and clay beds, forms a complex aquifer system. The Nubian Aquifer has been providing water to artesian wells and springs in the Kharga Oases for several thousand years. Groundwater in the Kharga Oases is withdrawn from springs and shallow and deep artesian wells. Nearly all the wells originally flowed, but with the exploitation of groundwater from deep wells for irrigation beginning about 1959, the natural flows declined as more and more closely spaced deep wells were drilled. By 1975 many deep wells had ceased to flow. The water demand in the area has been met by pumping both shallow and deep wells. The total annual extraction from deep wells has fluctuated over the year, however, the annual withdrawal from deep wells has exceeded extraction from shallow wells. About 1.7 billion cu m of water was withdrawn from the combination of shallow and deep wells during the period 1960-1980. The Nubian complex aquifer in the Kharga Oases has a very large groundwater potential that could be exploited and beneficially used for a long-term agricultural development in the area, provided proper well spacing and management are implemented. Other major environmental considerations for which precise hydrogeologic data are needed include: 1. Determination of the long-term yield available from properly constructed are producing artesian wells that will support a planned migration of population from the overcrowded Nile delta and flood plain areas. 2. Development of an effective management program and adequate staff to maintain groundwater production over an extended period of years. 3. The impact on climate caused by extensive irrigation in the oases of the Western Desert of Egypt. 4. Protection against water logging of soils from irrigation practices. 5. Protection against salinization of soils from irrigation practices. 6. Development of effective surface and subsurface drainage practices. 7. The impact of farming and pest control practices on the shallow groundwater of the oases. 8. Determination of the long-term development of the artesian water on the quality of the water from the aquifer systems in the Western Desert. This paper addresses items 1, 2, and 8. (Author's abstract)
W86-00554

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF SOIL EROSION ON SOYBEAN YIELDS AND CHARACTERISTICS OF CECIL-PACOLET SOILS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 2J.
W86-00339

EFFECTS OF SOIL EROSION ON SOYBEAN PRODUCTION IN THE SOUTHERN PIEDMONT OF GEORGIA IN 1982,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. White, R. R. Bruce, A. W. Thomas, G. W. Langdale, and H. R. Perkins.
Erosion - Productivity Investigations, 1982, Research Report No. IRC 060183, June, 1983. 21 p, 5 Fig, 5 Tab.

Descriptors: *Erosion, *Soil erosion, *Rainfall, *Soil water, *Soybeans, *Crop production, *Plant growth, *Crop yield, Potassium, Magnesium, Soil conservation, Phosphorus, Erosion control, Soil horizons, *Georgia.

Twenty-four fields within a 25-mile radius of Watkinsville, Georgia were planted in soybeans to evaluate the effects of erosion on crop growth and production. Three plots within each field were classified as slightly, moderately, and severely eroded. Pedon descriptions were made to 60-inches deep for each erosion level and rainfall and soil water were measured twice weekly from mid-July to the end of the growing season. Results showed that erosion reduced plant growth, yields, and stands. Soybean yields averaged 41.3, 28.1, and 19.8 bushels/acre for the slight, moderate, and severly eroded areas, respectively. Both stover and bean yields were reduced 52% on the severely eroded areas compared to the slightly eroded sites. Soil tests on plow layer samples indicated that severely eroded sites had markedly lower levels of P compared to slightly eroded soils, while K and Mg were lowest on slightly eroded areas. Although complete interpretation of results are not possible at this time, these preliminary data present overall evidence indicating marked effects of erosion on soybean yields on these soils based on current agricultural practices.
W86-00340

BIOMASS OF MACROPHYTES IN THE CHANNEL RUNNING THROUGH AGRICULTURAL AREAS,
Polish Academy of Sciences, Poznan. Dept. of Agrobiology and Forestry.
For primary bibliographic entry see Field 2H.
W86-00436

HUMAN ECOLOGY OF THE JAMES RIVER,
Richmond Univ., VA. Dept. of Biology.
J. W. Bishop.
Virginia Journal of Science, Vol. 36, No. 1, p 14-18, 1985. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Environmental effects, *Water quality, *James River, *Virginia, Water pollution sources, Hydrologic cycle, Dam effects, Climate, Water supply, Water resources development.

The James River is part of the hydrologic cycle, which includes precipitation, evapotranspiration, surface runoff, and groundwater flow. People influence the supply of water both directly, as in the construction of reservoirs, and indirectly, as in the 'greenhouse effect', which affects climate, and therefore water supply. Following the James River from its headwaters on the Jackson River to its mouth demonstrates a pattern of increasing human involvement with the river, from farm ponds, to pumped storage electrical generation, to heavy industrial use. Water quality changes, generally for the worse, as the river progresses from relatively undeveloped to heavily developed areas. The river and the human population along its banks are interdependent. The population of the area, particularly at Richmond, has benefitted from the river, throughout history and can preserve the river for future use through employment of proper stewardship. (Rochester-IVI)
W86-00583

4D. Watershed Protection

BANK PROTECTION TECHNIQUES USING SPUR DIKES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-00311

LONG ISLAND SOUND THAMESVILLE TIDAL-FLOOD MANAGEMENT WATER RESOURCES STUDY, NORWICH, CONNECTICUT.
Corps of Engineers, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA 120075. Reconnaissance Report, Stage 1, February 1981. 61 p. 7 Fig, 3 Tab, 4 Plates, 1 Append.

Descriptors: *Tidal floods, *Flood damage, *Floodproofing, *Flood protection, Thames River Basin, Connecticut, Planning, Economic aspects, Cost-benefit analysis, Interagency cooperation, Public policy.

The Thamesville area of Norwich, Cor
has the potential for severe flood dam
tides. This report identifies the problem
and opportunities of the study area and th
detail required to formulate any intermedi
Preliminary investigations have indicated
Standard Project Hurricane (SPH) wo
enormous damage. An increase in future
tion and encroachment on the flood plai
expected to increase flood damages and
the problems the already exist. Protecti
area is feasible and would protect the i
area from inundation. One environment
would be the protection of the existing
Local interests consider protection aga
flooding to be beneficial to the future de
of the Thames River Basin and to th
Norwich.
W86-00372

**SEDIMENT LOSSES FROM CROPLA
ROWS OF DIFFERENT GRADIENTS,**
Science and Education Administration
MS. Sedimentation Lab.
For primary bibliographic entry see Fiel
W86-00467

**SOIL LOSS FROM COTTON WITH
VATION TILLAGE,**
Science and Education Administration
MS. Sedimentation Lab.
C. K. Mutchler, L. L. McDowell, and J.
Transactions of the American Society c
tural Engineers, Vol. 28, No. 1, p 160-16
January/February, 1985. 1 Fig, 3 Tab, 3

Descriptors: *Soil erosion, *Soil loss,
*Conservation tillage, Rainfall, Precipit
age, Erosion control,.

Erosion rates were documented and
were calculated from conservation
cotton grown on upland slopes. Three
tems for cotton were evaluated for erosi
effectiveness. Each of the three system
prior cropping histories. Soil loss ratios
puted for each crop stage to allow their
Universal Soil Loss Equation (USLE) f
ing soil loss from cotton. Soil loss fro
no-till cotton after no-till soybeans-whe
crop was below tolerable soil loss limits
by the Soil Conservation Service. Res
from cotton is less than from soybeans
and the peculiar tap root system of the c
contributes little to holding soil in
greatly beneficial effect of conservatio
seen in the comparison of plots con
tilled but with either an 11 year no-till o
tional-till history. The no-till history
affected erosion because soil loss from c
al tillage was reduced by 47%, runoff
35% of the rainfall compared with 48%
term conventional tillage, and seed c
increased about 20%. (Baker-IVI)
W86-00497

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollut

**GROUNDWATER MONITORIN
SAMPLE BIAS,**
Waterloo Univ. (Ontario). Dept. of Ear
For primary bibliographic entry see Fie
W86-00345

**REFINERY WASTEWATER PRIOR
LUTANT STUDY - SAMPLE ANAL
EVALUATION OF DATA.**
Radian Corp., McLean, VA.
American Petroleum Institute, Washi
December 1981. 342 p. 9 Fig, 33 Ta
Append.

criptors: *Oil wastes, *Gas chromatography, ss spectrometry, Isotope dilution, Internal dard, Atomic absorption spectroscopy, Induc- y coupled argon plasma spectroscopy, Varia- y, Effluents, Chemical analysis, Benzenes, Or- c compounds, Chloroform.

report discusses the bias and within-laborato- recision of several analytical methods in order ssess reliably the magnitude and day-to-day ation of pollutants concentrations in two refin- wastewaters. Organic pollutants were deter- d by comparing two gas chromatography- spectroscopy techniques: 'isotope dilution' vs rnal standard'. Elemental pollutants were ana- l by atomic absorption (AA) and/or induc- y coupled argon plasma spectroscopy (ICAP). h of the variability in measurements of final ent concentrations is due to variability associ- with the analytical methods currently avail- to measure effluent concentrations at the part- illion level of such priority pollutants as ylene chloride, benzene, toluene, chloroform, phthalates. The two refineries were remark- similar with respect to the pollutants present influent and effluent samples and the concen- ns of these pollutants. The use of the isotope on procedure offered no advantage over the al standard procedure in terms of eliminating een-laboratory bias or improving within-labo- y precision. The ICAP and AA methods of ental analysis are essentially equivalent for ring chromium and zinc in refinery waters.
00378

RACTERIZATION OF INDUSTRIAL EOUS DISCHARGES BY THE TLC/AMES'
Y,
alinstitutt for Industriell Forskning, Oslo way).
oller, L. H. Landmark, A. Bjorseth, and L.
erg.
osphere, Vol. 13, No. 8, p 873-879, 1984. 3 Tab, 7 Ref.

iptors: *Pollutant identification, *Ames test, layer chromatography, *Industrial wastes, ile mill wastes, Organic compounds, Muta- Wastewater analysis, Textile industry.

n situ detection of mutagens by the thin layer atography/Ames' assay has been applied to us discharges from a textile plant. The sam- vere fractionated in acid/neutral and basic ns which subsequently were subject to the Ames' test. The waste water contains a r of chemicals which for example are used riers and additives in order to improve the s and the products. The results of the study strate that even if the mutagenic activity ses in the presence of S9, the individual nents may have increased activity. This il- es the importance of separating the chemi- ith different mutagenic properties. The mu- c response was significantly lower for the fraction than for the acid/neutral fraction. g of the basic fraction in the presence of S9 t reveal any mutagenic response significantly the level of spontaneous revertants, hence -mixture has completely deactivated the mu- in the basic fraction. These results demon- he convenience of characterizing mutagenic unds by the TLC/Ames' test. By simple al fractionation, standardized TLC condi- nd various bio-assay systems, valuable infor- may be obtained prior to detailed chemical terization by gas chromatography/mass ometry or other advanced analytical tech- (Baker-IVI)
0389

ELECTIVE ELECTRODES (ISE) - RE- CH INTO THE POTENTIAL REGULA- AND APPLICATION IN ANALYSIS NSELEKTIVE ELEKTRODEN (ISE) - RSUCHUNGEN ZUR POTENTIALEIN- LUNG UND ANWENDUNG IN DER ANA-
),
sche Hochschule 'Carl Schorlemmer' Merseburg (German D.R.).

U. P. Decker, and R. Geyer.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 19-27, 1984. 4 Fig, 4 Tab, 9 Ref.

Descriptors: *Ion-selective electrodes, *Water analysis, Water treatment, Iodides, Sulfides, Cyanides, Chlorides, Electrodes, Water quality control.

The necessity for the use of ion-selective electrodes in the water-control practice and for process control in water treatment processes is explained. After the description of the general construction principle of measuring systems for recording potential differences, special data and details are presented concerning the composition of the ion-selective electrodes. The principle of operation and the dependence on special conditions are described using theoretical considerations as examples. The following detection sensitivities with ion-selective electrodes (solid membranes) are given: iodide 0.01- 0.0000001; sulfide 0.01-0.000001; and cyanide 0.01-0.00001 mol/l. It may also be possible to detect chloride concentrations lower than 0.00001 mol/l with the aid of ion-selective electrodes on a solid membrane basis. (Author's abstract)
W86-00395

THIN-LAYER CHROMATOGRAPHIC DETERMINATION OF TRIAZIN HERBICIDES IN WATER (DUNNSCHICHTCHROMATOGRAPHISCHE BESTIMMUNG VON TRIAZIN-HERBIZIDEN IN WASSER),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
D. Lienig, B. Wiemer, and I. Zolfel.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 29-37, 1984. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Thin-layer chromatography, *Herbicides, *Triazine, Water analysis, Chromatography, Pollutant identification.

A description is given of thin-layer chromatographic determination of Triazine herbicides after chloroform extraction and detection with 0.1 N AgNO3 solution and irradiation by ultraviolet light. For simazine, Atrazine and Prometryne, the detection limits are at 0.05 micro-g. Disturbances can be avoided if two different mobile solvents are used and preliminary clean-up by thin-layer chromatography is done. The agreement of the Rf-values in two different mobile solvents with the Rf-values from known standard solutions is used as the criterion of identification. (Author's abstract)
W86-00396

POSSIBILITIES OF THE CORRELATION OF DIFFERENT WATER ANALYSIS METHODS (MOGLICHKEITEN DER KORRELATION UNTERSCHIEDLICHER WASSERANALYSEN-VERFAHREN),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
F. Winkler, B. Duwert, and H. Patecki.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 239-246, 1984. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Water analysis, *Wastewater treatment, Surfactants, Organic carbon, Chemical oxygen demand, Biochemical oxygen demand, Industrial wastewater.

The regressions and correlations between TOC, COD-Cr, COD-Mn, BOD5 and CHCl3-extract were investigated for model waters containing Prawozell W-ON 100 and Emulgator 30 as the most important tensides (synthetic surface active agents) as well as for the actual clarification plant influents of a chemical works. As expected, for the model waters in all cases highly significant regressions exist between the results of the different investigation methods. For the actual wastewater there can be demonstrated statistically secured connections with degrees of determination of 0.64-0.78 only for the pairs TOC - COD-Cr, BOD5 - COD-Cr, COD-Mn - COD-Cr and TOC - COD-Mn, due to the varying composition. The corresponding regression equations with their range of definition are given. They can contribute to rendering the acquisition of measured values more efficient and to control the wastewater treatment. (Author's abstract)
W86-00411

DETERMINATION OF SULFIDE IN WATER BY MEANS OF AN ION-SELECTIVE ELECTRODE (BESTIMMUNG VON SULFID IN WASSER MIT EINER IONENSELEKTIVEN ELEKTRODE),
Wasserwirtschaftsdirektion Saale-Werra, Halle (German D.R.).
H.-J. Neidhardt, and H. D. Steinleitner.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 247-253, 1984. 1 Fig, 17 Ref.

Descriptors: *Sulfides, *Ion-selective electrodes, *Water analysis, Potentiometry, Titration.

For the direct potentiometric measurement by means of a sulfide-selective solid-state membrane electrode (such as the reference electrode - a calomel electrode with a salt bridge filled with 1M KNO3-solution) a 25 ml sample is mixed with 25 ml sulfide-antioxidant buffer (0.2 M ascorbic acid in 2 M NaOH, Ag2S-saturated). Calibration is done with thioacetamide in the same buffer. This measuring arrangement determines sulfide concentrations of 0.0000015 to 0.001 M. If the buffer is added to the samples in the ratio of 1 + 1 during sampling, the sulfide content will be stabilized for at least 24 h. The measuring method and its calibration are compared with other methods of calibration with Na2S and potentiometric titration, idometric titration and photometric determination. The method developed proved to be very selective and requires a minimum expenditure of time. (Author's abstract)
W86-00412

THIN-LAYER CHROMATOGRAPHIC DETERMINATION OF MINERAL OIL IN WELL WATER (DUNNSCHICHTCHROMATOGRAPHISCHER NACHWEIS VON MINERALOL IN BRUNNENWASSER),
Bezirks-Hygieneinspektion und -Inst., Erfurt (German D.R.).
K. Machmerth.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 479-489, 1984. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Thin-layer chromatography, *Water analysis, *Mineral oil, *Well water, Pollutant identification, Drinking water, Chromatography.

A tabular survey is given from literature concerning seven extraction techniques, 14 thin-layer chromatographic detection techniques and 15 spray reagents. From the possibilities represented in this way, a newly composed method is described which can be carried out in any routine laboratory within one hour and has proved successful in situations of average of the drinking water supply. One l water is extracted with 25 ml CCl4, the extract is concentrated in the vacuum to 1 ml and chromatographed with n-hexane on a prefabricated foil. Detection is carried out with 10% methanolic molybdophosphoric acid. The detection limit is at 0.5 micro-g. (Author's abstract)
W86-00415

ANALYSIS OF CHLOROPHENOXYALKANE ACIDS AND CHLOROPHENOLS. PART 2: DETECTION OF CHLOROPHENOXYALKANE ACIDS AND CHLOROPHENOLS IN THE FISH BILE (ZUR ANALYTIK VON CHLORPHENOXYALKANSAUREN UND CHLORPHENOLEN. TEIL 2: NACHWEIS VON CHLORPHENOXYALKANSAUREN UND CHLORPHENOLEN IN DER FISCHGALLE),
Bezirksinstitut fuer Veterinarwesen Karl-Marx-Stadt (German D.R.).
K. Grahl, and H. Hermenau.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 491-497, 1984. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Chlorophenoxyalkane acids, *Chlorophenols, *Fish, *Chromatography, Pollutant identification, Herbicides, Thin-layer chromatogra-

phy, Monitoring, Pesticide residues, 2,4-D, MCPA, MCPP, Dichlorophenols, Methylchlorophenols.

The bile liquid is preserved with ethanol and the protein is precipitated. Prefractionation is done by liquid-liquid extraction using chloroform and ethyl acetate. The extracts are separated on Florisil with column-chromatography and subsequent detection by thin-layer chromatography. To determine the identity of substances, the penta fluorobenzyl derivatives are prepared and chromatographed under the same conditions. Detection is carried out with the aid of ammoniacal silver nitrate reagent and ultraviolet irradiation. The highly polar conjugates of chlorophenoxyalkane acids and chlorophenols which are present in the bile are cracked by acid hydrolysis and then cleaned-up by re-extraction. Using this method, 2,4-D, MCPA, MCPP, 2,4-dichlorophenol and 2-methyl-4-chlorophenol were detected from Salmo gairdneri; 6-21 d after the application of the herbicides in the catchment area their concentration in the fish bile amounted to about 200 mg/l, 90% of them were conjugates. Thus, the biliary excretion of xenobiotic substances offers an important new aspect of biomonitoring with fish tests, especially in the range of subacute and chronic toxicity. (Author's abstract)
W86-00416

MODEL ECOSYSTEMS AS A TOOL IN FRESHWATER AND MARINE RESEARCH,
National Swedish Environment Protection Board, Solna.
A. Lundgren.
Archiv fur Hydrobiologie, Suppl. 70, No. 2, p 157-196, 1985. 9 Fig, 1 Tab, 144 Ref.

Descriptors: *Reviews, *Ecosystems, *Water pollution, *Model studies, Microcosms, Toxicity, Biodegradation, Biological magnification, Ecology, Food chains, Fate of pollutants, Water pollution effects.

This review is a survey of recent studies in aquatic ecotoxicology and experimental ecology, where model ecosystems were used as test systems and is an attempt to provide both theoretical and practical aspects on the strategy of model ecosystem design. Small synthetic laboratory microcosms are easily replicated and well suited for standardization. Two examples are described representing the model ecosystems and the model food chain. These microcosms are characterized by a very simplified structure and a reduced number of biotic and abiotic interactions and can not be regarded as models of any specific natural ecosystem. Experiments in small laboratory microcosms can, however, provide information on general ecosystem behavior and give quantitative indexes on biodegradability of chemical substances, ecological magnification, etc. If information on fate and effects of toxic chemicals on more specific natural ecosystems is needed, much more complex model ecosystems must be used. This is easiest done by isolating a part of a natural ecosystem. Different large-scale model ecosystems covering pelagic bags, benthos enclosures, enclosures of the profundal zone, combination enclosures with both benthic and pelagic communities and experimental ponds and lakes are described. The artefacts introduced by enclosure and scaling are discussed together with different ways to minimize their effects. The controversy between realism and replication is discussed and it is finally concluded that experiments in large-scale model ecosystems can provide valuable information on the fate and effects of pollutants in natural ecosystems. (Author's abstract)
W86-00526

BIOMONITORING OF THE CONTAMINATION OF WATER BY A SUBLETHAL CONCENTRATION OF PESTICIDES - A SYSTEM ANALYSIS APPROACH,
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, and I. P. Tonk.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 399-409, 1984. 5 Tab, 32 Ref.

Descriptors: *Monitoring, *Bioassay, *Pesticides, *Systems analysis, Heteropneustes, Chlordane, Aldrin, Metasystox, Dichlorvos, Carbofuran, Sevin, Enzymes, Respiration.

Heteropneustes (Saccobranchus) fossilis (Pisces; Clariidae) was exposed to the biocides Chlordane, Aldrin, Metasystox, Dichlorvos, Carbofuran and Sevin for 30 d at a concentration of the 1/5 fraction of LC50;96h with daily exchange of the medium. At intervals of 5 d the respiration rate was determined for 1 h. In addition, after the end of tests 13 hematological parameters as well as the activities of the adenosine triphosphatases and acetylcholinesterase were determined in the liver, the kidney and the gills. During all exposures to biocides the respiration rate decreases significantly with the test time. At all exposures the blood concentrations of glucose, sodium- and chlorideions show a significant increase, whereas the cholesterin content and the clotting time decrease significantly. The ATPase activity is significantly reduced only by Aldrin and Cholordane. A significant reduction of the acetylcholinesterase activity occurs in each of the three investigated tissues only for Metasystox and Dichlorvos and in the liver in addition also for Chlordane, Aldrin and Carbofuran. Therefore, the respiration rate and hematological criteria permit a general stress indication, enzymatic activities constitute a specific indication of individual groups of biocides, so that a systematic analysis of these three indication groups will probably provide a specific resultant statement in a biomonitoring system due to the specific inhibition pattern. (Author's abstract)
W86-00542

METHOD FOR DETERMINING AMMONIA NITROGEN IN WATERS (METHODE ZUR BESTIMMUNG DES AMMONIAKSTICKSTOFFES IN GEWASSERN),
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
I. Hoffmann, B. Nagy, and J. Schneider.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 645-651, 1984. 1 Fig, 9 Ref.

Descriptors: *Ammonia, *Water analysis, *Spectrophotometry, Nitrogen, Lake Balaton, Hungary.

For the spectrophotometrical determination of ammonia in surface water the reaction with hypochlorite and thymol in alkaline solution is used. Compared with other techniques, expenditure is low, the reagents are stable for a long period of time and the reaction is little dependent on external conditions. In 2 cm cuvettes there can be determined 0.05-0.5 mg/l ammonia nitrogen. Comparative investigations carried out at nine sites in the area of the lake Balaton have revealed concentrations of 0.2-0.7 mg/l ammonia nitrogen. (Author's abstract)
W86-00550

PHYSIOLOGICAL RESPONSES TO POLLUTION,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5C.
W86-00597

STATE MUSSEL WATCH: TOXICS SURVEILLANCE IN CALIFORNIA,
California State Dept. of Fish and Game, Monterey.
M. Martin.
Marine Pollution Bulletin, Vol. 16, No. 4, p 140-146, April, 1985. 5 Fig, 5 Tab, 25 Ref. NOAA grant NA 81 AAHCZ 162.

Descriptors: *Monitoring, *Bioaccumulation, *Mussels, *California, Toxicity, Coastal waters, Trace metals, Polychlorinated biphenyls, Silver, DDE, Toxaphene, Endosulfan I, Pesticides, Lead, Copper, Zinc.

The California State Mussel Watch Program is described and an explanation is given as to where mussel watch findings have been used in regulatory or abatement action on trace toxic substances. Results of coastal monitoring of trace toxic substances are reported along with the biological effects measurements in synoptic studi Francisco Bay, chemical and biological at a major wastewater discharge in sou fornia, and the use of mussel watch data tion of toxics discharge to California r estuarine waters. Chromium, copper an centrations in mussels are consistently stations near major southern California discharges. Lead levels were elevated in ern California area. There was an unex spot found in Monterey Bay, central which caused a special intensive site stu ed concentrations of p,p'-DDE were fo Southern California Bight. Mussels coll South San Francisco Bay near Redw had high levels of silver in earlier invest the 1983-84 study, a source for this ele was not found. Mussels collected from ing Harbor and Elkhorn Slough con highest concentration of toxaphene and I. At the state level, California uses Quality Control Plan for Ocean Waters nia to regulate waste discharge to oc The United States National Oceanic a pheric Administration recently initiated called the National Status and Trends response to a general concern about th for bioaccumulation of synthetic organic in marine/estuarine areas of the US. T Status and Trends program contains watch component to produce data th collected, and be incorporated in report ant conditions in the nation's mari (Baker-IVI)
W86-00598

5B. Sources Of Pollution

CALCIUM CHLORIDE: ENVIRO AND TECHNICAL INFORMATI PROBLEM SPILLS.
Environmental Protection Service, Ott io).
For primary bibliographic entry see Fie
W86-00309

FERRIC CHLORIDE: ENVIRONME TECHNICAL INFORMATION FOR SPILLS.
Environmental Protection Service, Ott io).
For primary bibliographic entry see Fie
W86-00310

CHLORINE: ENVIRONMENTAL A NICAL INFORMATION FOR SPILLS.
Environmental Protection Service, Ott io).
For primary bibliographic entry see Fie
W86-00319

COASTAL MARINE RESOURCES RY, 1983: PEMAQUID POINT TO HEAD,
Maine State Dept. of Marine Reso Boothbay Harbor. Marine Resources L
For primary bibliographic entry see Fie
W86-00322

SOURCES, CHEMISTRY, FATE, FECTS OF CHROMIUM IN AQUA RONMENTS.
Ecological Analysts, Inc., Sparks, MD. American Petroleum Institute, Washi November, 1981. 191 p. 22 Tab, 210 Re

Descriptors: *Reviews, *Chromium, * lutants, *Water pollution sources, *Wa effects, *Toxicity, *Water quality stan lutant identification, Heavy metals, M cumulation, Uptake, Nonpoint pollut Aquatic animals, Aquatic plants, Indus

A comprehensive body of informatio tion, chemistry and fate, principal s biological effects of Cr in surface wate

ontext with regulatory applications for the of Cr discharges. Analytical methods for rmination are described and evaluated. The ry of Cr in water is discussed as it relates to al availability. The effects of hydrolysis, on, precipitation, adsorption, and bioaccun in determining the fate of Cr are dis- The most recent data available on industri- publicly owned treatment-works point- contributions of Cr to surface waters are and estimates are provided. Anthropogen- oint sources are also mentioned. The effects ngestion on human health and its role in nutrition are presented. A comprehensive of the effects of Cr on aquatic organisms data on acute and chronic toxicity and nulation. Biotic and abiotic factors which Cr toxicity and uptake are discussed. A of federal Cr criteria and the technical behind their development is presented ith a listing of current state water quality and standards. The existing regulatory rk concerning the discharge of Cr in in- point source effluents is discussed with on how regulatory agencies can use oxicity data to derive water quality crite-

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CATION AND TRANSFER OF THER- OLLUTION MODEL; VOLUME IV: MANUAL FOR THREE-DIMENSION- D-LID MODEL,
niv., Coral Gables, FL. Dept. of Mechani- neering.
. S. Sengupta, E. V. Nwadike, and S. K.

from the National Technical Information Springfield, VA 22161 as PB83-116103. EPA-600/7-82-037d, May 1982. 145 p. 8 b, 4 Ref, 2 Append. Contract/Grant No. 9410.

rs: *Computer models, *Thermal pollu- athematical models, Lake basins, Lakes, programs, Path of pollutants.

e-dimensional rigid-lid model was devel- he thermal pollution group at the Univer- iami and verified for accuracy at Lake South Carolina. The model results were urate in all the verification runs. The intended to be used for hydrothermal s of closed basins subjected to a heated together with various other inflows and This manual has been written to enable o be able to apply it without difficulty. n of the governing equations and various ils have been omitted.
6

ORT, FATE AND EFFECTS OF -RELATED POLLUTANTS: EVALUA- SURFACE AND GROUNDWATERS; X 1: PRELIMINARY LISTING OF E SURFACE WATERS,
en National Lab., Upton, NY. Dept. of d Environment.
drey, H. C. Thode, and N. Gmur.
from the National Technical Information Springfield, VA 22161 as No. 14. Second Progress Report, September -51473, Volume 2. 130 p. 31 Fig, 17 ef, 2 Append. Contract/Grant No. DE- H00016.

s: *Acidic water, *Alkalinity, *Water Acid rain, Conductivity, Hydrogen ion ions, Water pollution effects, Ground- face Water.

vity of freshwaters of the eastern United cidification was evaluated by identifying g specific sites at which low alkalinity exist, or at which there has been an acidity or decrease in alkalinity. Efforts concentrated on the acquisition of new ty data for inclusion in the Acidification Information Database (ACID), on ex- e list of chemical variables in the data- vising statistical methods for examining and improving the quality of the component data sets, and on analyses of temporal trends in water quality for selected states. Analyses of seasonal patterns in chemical variables are in progress as part of the temporal trend analysis. So far, > 3,500 stations have been provisionally identified as sensitive to acidification (alkalinity < or = 0.1 meq/liter. Data in ACID also indicate that 669 stations have statistically significant long-term decreases in alkalinity (further verification is required). State-by-state maps locating these stations are presented. This progress report also describes the current contents and status of ACID, presents results of searches for erroneous data, and describes ongoing and planned quality control procedures.
W86-00348

ENVIRONMENTAL RISK ASSESSMENT: THE POTENTIAL ROLE OF MICROBIAL EFFECTS TESTING,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
For primary bibliographic entry see Field 5C.
W86-00353

CHLORINATED PHENOLS AS CONTAMINANTS OF SOIL AND WATER IN THE VICINITY OF TWO FINNISH SAWMILLS,
Helsinki Univ. (Finland). Dept. of General Microbiology.
R. Valo, V. Kitunen, M. Salkinoja-Salonen, and S. Raisanen.
Chemosphere, Vol. 13, No. 8, p 835-844, 1984. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Saw mills, *Fungicides, *Water pollution sources, *Chlorophenols, Phenols, Surface water, Groundwater pollution, Leaching, Organic compounds, Fate of pollutants, Finland.

All the wood exporting sawmills in Finland use fungicide for preserving freshly sawn timber and lumber against losses during storage and shipment. The results of a study on the occurrence of chlorinated phenols at and around two Finnish sawmills, both of which used a typical wood preserving method, are reported. One mill (A) had been using chlorophenolic wood preservative for 2 seasons and mill B for 20 seasons. Mill A used a preserving method in which the lumber was not placed in a trickling basin after dipping. Mill B had a trickling basin for treated lumber. Soil around the basin was heavily contaminated. At mill A concentration of 70 mg chlorophenols/kg soil was found near the treatment basin while the figure for the same area at mill B was 30 mg/kg. The soil in the storage area for preserved wood contained up to 6 mg/kg at A and 1 mg/kg at B. The vertical distribution of chlorophenols in the soil was uneven, indicating that chlorophenols accumulate in certain layers more than in others. The main components of the wood preserving solution, 2,4,6-TCP, 2,3,4,6-TeCP and PCP, were usually the most abundant in soil at most sites. Polychlorinated phenols are thus stable in the sawmill surroundings. Groundwater samples taken from the vicinity of mill A were found to contain from 1.6 to over 20,000 micro-g of chlorophenols per liter, while the concentration detected in a nearby lake was only 40 ng/l. Contamination of household wells by the direct flow of groundwater from the dipping basin is improbable, because the water level in those wells was above the dipping basin. Leaching of chlorophenols from the storage area or transport through the air are more probable ways for the contaminants to spread. (Baker-IVI)
W86-00387

TETRACHLORODIBENZO-P-DIOXINS AND TETRACHLORODIBENZOFURANS IN ATLANTIC COAST STRIPED BASS AND IN HUDSON RIVER FISH, WATERFOWL AND SEDIMENTS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
P. O'Keefe, D. Hilker, C. Meyer, K. Aldous, and L. Shane.
Chemosphere, Vol. 13, No. 8, p 849-860, 1984. 3 Tab, 26 Ref.

Descriptors: *Tetrachlorodibenzo-p-dioxin, *Tetrachlorodibenzofuran, *Bass, *Fish, *Hudson River, *New York, Dioxins, Water pollution sources, Chlorophenols, Polychlorinated biphenyls, Chlorinated hydrocarbons.

The extent of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachlroodibenzofuran (2,3,7,8-TCDF) contamination of various populations of Atlantic Coast striped bass including fish from the Hudson River was examined. There was no evidence of contamination by 2,3,7,8-TCDD or 2,3,7,8-TCDF in samples of brook trout from a hatchery, with limits of detection varying from 0.6 to 2.2 ppt. Analytical results showed the 2,3,7,8-TCDD concentration in the striped bass from the Hudson River and its estuary to be significantly higher than the concentrations present in striped bass from Chesapeake Bay and Rhode Island coastal waters. A similar result was obtained from 2,3,7,8-TCDF, although the level of significance was reduced. The finding that concentrations of 2,3,7,8-TCDD greater than 5 ppt are confined to fish from the Hudson River should be considered in relation to the life cycle of the species. An effective program to control 2,3,7,8-TCDD/2,3,7,8-TCDF in the Hudson River striped bass population will require a knowledge of the sources of the contaminants to the river. Tentative findings suggest that these contaminants do not appear to be associated with a source in the upper Hudson River such as those previously described in polychlorinated biphenyl discharges. The presence of 2,3,7,8-TCDD as the only TCDD isomer in the sediment and fish suggests that the source of contamination is a chemical such as trichlorophenol where 2,3,7,8-TCDD is the only PCDD isomer which can be readily detected. Polychlorinated biphenyls are a possible source for 2,3,7,8-TCDF, with the documented evidence for preferential bioaccumulation of 2,3,7,8 substituted isomers accounting for the absence form the fish tissue of the other TCDF isomers found in the sediment. The similar concentrations in the fish over a 2 year period suggests that there is a constant exposure level in the river, but evaluation of sources requires additional data. (Baker-IVI)
W86-00388

DISTRIBUTION AND RATE OF DISAPPEARANCE OF FLUORENE IN POND ECOSYSTEMS,
Columbia National Fisheries Research Lab., MO.
T. P. Boyle, S. E. Finger, J. D. Petty, L. M. Smith, and J. N. Huckins.
Chemosphere, Vol. 13, No. 9, p 997-1008, 1984. 3 Fig, 2 Tab, 35 Ref.

Descriptors: *Fluorene, *Ponds, *Fate of pollutants, Distribution, Evaporation, Degradation, Sediments, Macrophytes, Ecosystems, Trophic level, Phytoplankton, Dissolved oxygen.

The environmental fate of fluorene applied at different concentrations to various experimental pond ecosystems was examined with emphasis on estimating the role of several physical, chemical, and biological factors in determining the relative distribution of fluorene in aquatic ecosystems and examining the use of the chemical parameters of fluorene to predict relative rates of its disappearance. Fluorene rapidly disappears from freshwater pond ecosystems. This disappearance is considered to have occurred in two modes: evaporation and sublimation from the surface of the pond, and degradation of the parent compound. Most of the fluorene applied to the ponds was not accounted for by the measurements taken in water, mud and plants. The trophic state of a lentic ecosystem may affect a number of environmental variables that also play important roles in determining the persistence of a chemical contaminant. Two factors connected with the level of productivity were significantly associated with the rate of fluorene disappearance: the density of phytoplankton as indicated by chlorophyll a, and the dissolved oxygen concentration at dawn. The rate of disappearance of fluorene was also linked to differences in productivity. Where the mean level of chlorophyll a was high, the rate of fluorene disappearance was also high; when the oxygen concentration over the nocturnal period, as

indicated by an early morning measurement, dropped low enough, fluorene degradation was retarded. The results of this study imply that eutrophic lakes and ponds are better able to degrade organic compounds such as fluorene than are oligotrophic systems. Moreover, aquatic environments with low dissolved oxygen concentrations may potentially have lower degradation potentials. (Baker-IVI)
W86-00391

CASE OF POLYCHLORINATED BIPHENYL CONTAMINATION OF WATER AND SEDIMENT IN THE SLOVENIAN KARST REGION (YUGOSLAVIA),
Maribor Inst. of Public Health (Yugoslovia).
S. Brumen, M. Medved, E. Voncina, and J. Jan.
Chemosphere, Vol. 13, No. 11, p 1243-1246, 1984. 2 Fig, 8 Ref.

Descriptors: *Polychlorinated biphenyls, *Fate of pollutants, *Karst hydrology, *Slovenia, *Yugoslavia, Industrial wastes, Waste disposal, Sediments, Water analysis, Chlorinated hydrocarbons,.

An incident is described in which polychlorinated biphenyls (PCBs) from an electro-industrial plant waste dump draining into groundwater channels in karst terrain have contaminated a potable water source. PCB composition data were obtained using quadropole GC-MS and capillary GC. The average level of PCBs determined in water was 0.3 micro-g/l and in sediment was 55 micro-g/g. From the negligible decline of degradable PCBs relative to the more persistent components, the impression is given that PCBs in a karst environment are rather stable. The decline of some lower chlorinated components in the PCB profile of sediment is more pronounced and could be explained as due to some physico-chemical effects such as lower incorporation into the sediment, transportation to air, release to water, and higher susceptibility to degradation. (Baker-IVI)
W86-00392

COPPER, ZINC, CADMIUM, AND LEAD IN SCALLOPS (PLACOPECTEN MAGELLANICUS),
Department of Fisheries and Oceans, St. Andrews (New Brunswick).
S. Ray, M. Woodside, V. E. Jerome, and H. Akagi.
Chemosphere, Vol. 13, No. 11, p 1247-1254, 1984. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Scallops, *Bays, *Georges Bank, *Browns Bank, *Bay of Fundy, *Copper, *Zinc, *Cadmium, *Lead, Metals, Fate of pollutants, Fish.

The total body burden of Cd for similar sized scallops from Georges and Browns Banks ranged from 135 to 245 micro-g compared with only 71 micro-g for scallops from the Bay of Fundy. The concentrations of Cd in individual tissues in all cases were also higher than those for Bay of Fundy scallops. Such differences did not occur for Cu, Zn, and Pb. The high body burden of Cd in scallops from Georges and Browns Banks far away from any known source of anthropogenic input is surprising and suggests a natural origin. The observation that Cd concentrations in medium sized animals are significantly lower than in either smaller or large animals has not been reported previously and possible physiological factors controlling it should be examined. It is not known whether high levels of the metal in the various tissues cause any physiological damage to the scallop but complete absence of large scallops from Browns Bank and their relative scarcity from George Bank may be related to the high body burden of Cd. There is also the possibility that the absence of large scallops may be related to the intense fishing in the area. (Baker-IVI)
W86-00393

INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Bezirks-Hygieneinspektion und -Inst., Potsdam (German D.R.).
L. Kalbe.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 145-152, 1984. 5 Tab, 25 Ref.

Descriptors: *Carp, *Aquaculture, *Eutrophication, Phytoplankton, Zooplankton, Lake sediments, Chlorophyll, Primary productivity, Cycling nutrients, Aquatic plants, Galenbeck Lake.

In Galenbeck lake, a shallow lake covering 700 ha and having a nutrient load of 0.23 g/sq ma P and 4.3 g/sq ma N, in 1965 a stock of 500 carp/ha was established and fed with grain. This stock of carp resulted in a considerable disturbance and redeposition of the soft lime sediments; the rich submersed vegetation disappeared and the phytoplankton reached a maxima of 885,420 cells/ml, whereas the zooplankton reached only 4530 ind./l. The chlorophyll content increased to 464 mg/cu m, and the depth of visibility decreased to 10 cm. The total planktonic primary production is estimated at at least 500 g/sq ma C. These changes are regarded as eutrophication, caused mainly by internal fertilization by an intensified recirculation of nutrients from the sediment, but also by the fertilization which is connected with feeding. The fish rearing ceased and the stock of carp was fished off; in 1970 a restoration of the lake began, and in 1974 the lake again reached its original state as a clear-water lake with an abundant population of macrophytes, supported by the P-retention in an upstream storage reservoir for spray-irrigation water. (Author's abstract)
W86-00406

PROBLEM OF INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (ZUR FRAGE DER KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Institut fuer Binnenfischerei, Berlin (German D.R.).
D. Barthelmes.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 153-161, 1984. 24 Ref.

Descriptors: *Carp, *Aquaculture, *Eutrophication, Macrophytes, Aquatic plants, Periphyton, Phytoplankton, Lake sediments, Galenbeck Lake.

Normally, carp rearing at medium densities is connected with the promotion of daphnia and filtration effects up to 'clear-water states'. Because of the reduction of submerged plants and of the periphyton, this form of carp rearing should be possible in eutrophic shallow lakes with a slight nutrient introduction without any considerable eutrophication. Due to the deterioration of the light climate by re-suspension of the sediment, even reductions in primary production are possible. In the case of Galenbeck Lake a drastic reduction of submerged macrophytes occurred in connection with an increased development of plankton, only general estimations being available of the shares of macrophytes and phytoplankton in the overall production. The phytoplankton increase is perhaps caused by the absence of filtering zooplankton due to an insufficient reduction of the indigenous fish stocks. In Galenbeck Lake, the structural changes in the ecosystem were due both to the high degree of resuspension of the very mobile lime sediment and the absence of hard bottom areas, which made the total reduction of the macroflora possible. (Author's abstract)
W86-00407

SIMULATION OF NITRATE DEGRADATION IN GROUNDWATER (SIMULATION DES NITRATABBAUS IM GRUNDWASSER),
Institut fuer Binnenfischerei, Berlin (German D.R.).
M. Schwan, D. Kramer, and C. Gericke.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 163-171, 1984. 2 Tab, 11 Ref.

Descriptors: *Groundwater pollution, *Nitrates, *Degradation, *Simulation, Groundwater recharge, Wastewater disposal, Diffusion, Convection, Kinetics, Differential equations, Model studies.

Ten reaction vessels containing 1 cu m w as the experimental arrangement. They w with coarse sand or fine gravel and install below the floor. The pore volume (wate tion) was 227-260 l. Anaerobic conditi established by the addition of 6 g gluco age. The reactors were given tap water and 200 mg/l NO-3 from KNO3 in such a a volumetric rate of flow of 0.2, 0.4 and 0. created. The volumetric rates of flow co ed to the natural recharge of groundw recharge of groundwater under the con irrigation and the conditions of an wastewater ground treatment. In the effl the reaction vessels the nitrate concentra determined every month. It was station the 7th to the 55th month after the beginn experiment. The experiments are eval means of a model which takes into acc diffusion, convection and kinetics of t degradation according to Michaelis-M simple method for solving homogeneous r differential equations of the second orde posed. The experimental and model resul good agreement and prove the very slo degradation in the groundwater with k mg/l, v max = 1.5 mg/l.d or k1 = (Author's abstract)
W86-00408

INDICATOR BACTERIA IN WATE STREAM SEDIMENTS NEAR THE RANGE IN SOUTHERN WYOMING,
Rocky Mountain Forest and Range E Station, Fort Collins, CO.
H. L. Gray, and J. C. Adams.
Water, Air, and Soil Pollution, Vol. 25, 133-144, June, 1985. 4 Fig, 3 Tab, 21 Ref.

Descriptors: *Bioindicators, *Bacteria, pollution, *Sediments, *Wyoming, Fe forms, Fecal streptococci, Water pollutio Coliforms, Pollutant identification, Recreation.

Water samples were taken at eight pools in the Nash Fork watershed after snown summer of 1980. The watershed is b Snowy Range escarpment, and principal include skiing and other winter sports, cattle grazing, camping and fishing, an homes. Water taken before and after stream bottom sediment were analyzed coliforms (FC) and fecal streptococci counts in undisturbed pool influent wat from 0 to 30 colonies per 100 mL of w FC densities were less than 1 colony per water in only 10 of 24 samples taken du month study. The streamwater was qu for drinking without treatment, but wa for all other recreational uses. The main FC were sheep and cattle. Stream sedi not a source. Study sites most impacted tion use had low FC densities. Only crossed by the band of 1000 sheep in A seriously degraded by fecal contaminatio a period of one month, and in the a continued fecal contamination, bacterial the stream moss samples decreased from per g of wet moss in August to 5 FC in S FS counts in the undisturbed pool influ ranged from 6 to 590 colonies per 100 m and were also highest at sites most im sheep and cattle. FS densities ranged fr 19.5 times greater in the pool effluent t influent water. The sediment appeare harbored FS bacteria that had survive multiplied. No significant evidence was major long-term, cumulative increases i densities in stream water and bottom sed to past and present sheep and cattle g recreation use. The levels of FC and F associated with present land uses will lik relatively constant from year to year long winters, annual streamflow rep from the melting snowpack, and sc streams as a result of high spring an runoff. (Baker-IVI)
W86-00428

DIMENT ACID NEUTRALIZATION IN FTWATER LAKES,
nnesota Univ., Minneapolis. Dept. of Civil and ning Engineering.
r primary bibliographic entry see Field 2H.
6-00432

PACT OF THE SILVER CARP (HYPHTHALMICHTHYS MOLITRIX VAL.) ON E ECOSYSTEM OF CARP PONDS,
ytut Rybactwa Srodladowego, Piaseczno land). Dept. of Pond Management.
Piotrowska-Opuszynska.
logia Polska, Vol. 32, No. 2, p 307-339, 1984. Fig, 5 Tab, 58 Ref.

criptors: *Fish farming, *Silver carp, *Fish ds, *Physicochemical properties, Aquaculture, solved oxygen, Chlorophyll, Carp, Primary ductivity, Phytoplankton.

effect of the silver carp on the physico-chemi- conditions of the carp pond habitat was stud- A determination was also made of the mecha- s via which it modified the habitat. The pres- e of the silver carp brought about significant nges in the physico-chemical and biocoenotic ditions of the ponds. In all cases, an increase found of chlorophyll content in the water and gher primary production, relative to the con- ponds stocked with carp alone. The loading of water with organic matter increased, this being cated by the amount of nitrogen, phosphorus organic carbon. The level of mineral com- nds was lower. As densities of silver carp in- sed, the level of oxygen in the water rose. silver carp larvae, the content of chlorophyll e water was higher, and so was the primary uction, the amount of oxygen was lower than e control ponds. This is attributed to the lack rganic matter elimination by the silver carp e. The silver carp caused an intensive growth e phytoplankton via a complex effect on the ystem. Although it did not fulfill the original s concerning the control of water eutrophica- the silver carp played a positive role as a r taking part in the control of the living itions of the fish in the ponds. It gave an ional piscicultural production due to a better ation of the food resources of the habitat. It be considered a species desirable in fish farm- especially in carp ponds. (Baker-IVI)
-00439

IMENT COMPOSITION FOR NONPOINT RCE POLLUTION ANALYSES,
ue Univ., Lafayette, IN. Dept. of Agricultural neering.
Foster, R. A. Young, and W. H. Neibling.
sactions of the American Society of Agricul- Engineers, Vol. 28, No. 1, p 133-139 and 146, ry/February, 1985. 5 Fig, 2 Tab, 23 Ref. contract W-7405-ENG.36.

riptors: *Nonpoint water pollution sources, utant analysis, *Path of pollutants, *Sedimen- , Soil properties, Clay, Silt, Aggregates, Mathematical equations, Model studies.

ort is offered of the development of relation- for sediment distributions and the composi- f aggregates near the point of detachment as ction of the most basic soil property, primary le distribution in the matrix soil. Data from ils were analyzed to develop equations that be sediment characteristics, including distri- n of particle classes and composition of the le classes as a function of the primary particle ution in the matrix soil. Important sediment le classes identified were primary clay, pri- silt, and primary sand and small aggregate, rge aggregate. The equations calculate the ns of these classes in the sediment at its point tachment, the clay and silt fractions in the aggregates class, and the clay, silt, and sand ns in the large aggregate class. The equa- derived for estimating the composition of the le classes can be used, together with specific e areas, to compute enrichment ratios for ting the change in contaminant concentra- f sediment when deposition changes the composition of the sediment. The equations describe sediment characteristics at the point of detachment and not at the edge of fields. They are intended for use in erosion/sediment yield models, for field-sized areas, that route sediment by particle classes to compute changes in sediment characteristics caused by transport and deposition between the point of detachment and edge of field. (Baker-IVI)
W86-00493

RELATIONSHIP OF CELLULAR PHOSPHORUS IN THE CYANOBACTERIUM NODULARIA TO PHOSPHORUS AVAILABILITY IN THE PEEL-HARVEY ESTUARINE SYSTEM,
Western Australia Univ., Nederlands. Inst. of Agriculture.
For primary bibliographic entry see Field 2L.
W86-00531

TRANSFORMATIONS OF SUBSTANCES IN AQUATIC SYSTEMS AND THEIR HYGIENIC EVALUATION (STOFFTRANSFORMATIONEN IN AQUATISCHEN SYSTEMEN UND IHRE HYGIENISCHE BEWERTUNG),
Institute of General and Municipal Hygiene, Moscow (USSR).
G. N. Krassovski, A. A. Korolew, S. I. Scholdakowa, R. Koch, and H.-J. Dobberkau.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 363-368, 1984. 2 Tab.

Descriptors: *Chemical reactions, *Fate of pollutants, *Toxicity, Bioaccumulation, Water treatment, Drinking water, Carcinogens, Mutagens, Teratogens, Organic compounds, Oxidants.

Chemical substances can be transformed under the influence of physical/chemical and/or biochemical active factors. By this, the ecotoxicological and hygiene-toxicological properties and effects of the substances are changed also with respect to toxicity, late effects (carcinogenetic, mutagenic, teratogenetic ones) as well as the bio- and geo-accumulation behavior. Such transformations occur also during water treatment, and therefore also the properties and effects of the transformation products have to be taken into account for determining the limit values for pollutants in raw water for the production of drinking water. Since frequently one has incompletely known transformation products or mixtures of substances, a coefficient of hazard is suggested for the evaluation. It is the quotient of the threshold concentrations of the initial substance and of the transformation products for the different (organoleptic, toxic, carcinogenic, teratogenetic etc.) effects. For several organic substances it is demonstrated that the transformation products can be regarded less toxic compared with the initial substance. Strong oxidants, however, cause an increased danger in many cases. (Author's abstract)
W86-00538

RELATIONSHIP BETWEEN ORGANIC CARBON AND CHEMICAL OXYGEN DEMAND,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
For primary bibliographic entry see Field 2K.
W86-00540

MODEL OF A BACTERIAL CULTURE UTILIZING A TOXIC SUBSTRATE IN CONTINUOUS FLOW CONDITIONS,
Bulgarian Academy of Sciences, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika.
S. E. Teodorova, and I. K. Sivriev.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 637-643, 1984. 3 Fig, 12 Ref.

Descriptors: *Bacteria, *Toxic substances, Mathematical equations, Fate of pollutants, Biological wastewater treatment, Enzymes, Bacterial decomposition.

A model for the population growth of a bacterial culture growing by use of a single toxic substrate is presented and discussed. The model for an enzymatic reaction with one substrate, which simultaneously acts on the enzyme as an irreversible inhibitor, is: S + E (which leads irreversibly to E' with rate constant k sub 3) leads reversibly to C (k sub 1 = forward rate constant, k sub -1 = backward rate constant), which in turn leads irreversibly to P + E, with rate constant k sub 2, in which S = substrate, E = enzyme, E' = inactivated enzyme, and P = product. The equation for the stationary state has the form dc/dt = 0 = k sub 1(s-c) (e-c-e') - k sub -1(c) - k sub 3 (s(2)) - k sub 2 (c), in which the small letters are the corresponding concentrations. It is assumed that the velocity of inactivation of the enzyme is proportional to the square of the concentration of the substrate: de'/dt = k sub 3 (s(2)). To use the equation in the stationary state, it is suggested that the concentration of the inactivated enzyme is negligibly small compared to the concentration of active enzyme. The relative velocity of growth of the bacterial culture, the growth of the bacterial culture that degrades substrate S, the influence of the concentration of toxic substrate on the relative velocity of biomass synthesis may be obtained from this model. The model applies in the investigation of the stability of the biological processes employed for the degradation of different toxic substances and for the explanation of the specific mechanism of the inhibiting action of the toxic substances on the various microorganisms. The model may be used for selecting optimum conditions and parameters for biodestruction of noxious substances in water pools and purifiers. (Rochester-IVI)
W86-00549

ACID MINE DRAINAGE CONTAMINATES GROUNDWATER OF A TENNESSEE WATERSHED,
Tennessee Cooperative Fishery Research Unit, Cookeville.
C. J. O'Bara, and R. D. Estes.
Environmental Geology and Water Science, Vol. 7, No. 3, p 159-161, 1985. 2 Tab, 7 Ref.

Descriptors: *Groundwater pollution, *Acid mine drainage, *Springs, *Tennessee, Water pollution sources, Surface mines, Abandoned mines, Acidity, Hydrogen ion concentration, Sulfates, Iron, Manganese, Elevation, Hydrogeology.

Surface mining began in the West Fork of the Obey River Watershed, Tennessee, during the early 1900s and ceased in the 1950s. Water samples were collected from 18 natural springs within the West Fork of the Obey River watershed to determine if groundwater was adversely affected by runoff from abandoned surface coal mines. Six springs were found to be affected severely and deemed unfit as a source of potable water. The degraded springs were located on the Cumberland Plateau and along the western escarpment of the plateau. Generally, water of affected springs had pH less than 6.0, total alkalinity less than total acidity, and high sulfate, iron, and manganese concentrations. Water quality of the remaining springs was essentially unaffected. Three major factors were identified as possible causes in determining the quality of groundwater in the watershed. The proximity of a spring to an abandoned mine was considered important in determining the quality of the water. A second factor was the elevation at the outflow of a spring, which can be associated with different aquifers. The third factor was the geological characteristics of the strata surrounding the spring. (Moore-IVI)
W86-00555

DISTRIBUTION AND BACKGROUND OF TOTAL MERCURY IN SEDIMENTS FROM BOHAI BAY,
National Bureau of Oceanography, Hangzhau (China). Second Inst. of Oceanography.
X. Zhang, and X. Liao.
Marine Sciences, Vol. 9, No. 1, p 32-37, January, 1985. 9 Fig, 2 Tab.

Descriptors: *Mercury, *Sediments, *Bohai Bay, *China (Peoples Republic), Heavy metals, Water pollution sources, Estuaries, Bays.

One hundred twenty-one samples of the surface sediments were taken from Bohai Bay (Peoples Republic of China) in 1978-1980; their total mercury values ranged from 0.005 to 0.560 ppm, with an average value of 0.065 ppm. The higher levels (0.05 ppm) were in the west part of the Bay adjacent to the estuary of Beitang. The contents of mercury decreased rapidly with increasing distance from the estuary. The area of Bohai Bay polluted by mercury accounts for 5%. According to the data from 7 cores, the background of total mercury was confirmed to be 0.05 ppm. (Author's abstract)
W86-00579

PROCESSES OF BIOACCUMULATION: THE IMPORTANCE OF CHEMICAL SPECIATION,
Institute for Marine Environmental Research, Plymouth (England).
A. Nelson, and P. Donkin.
Marine Pollution Bulletin, Vol. 16, No. 4, p 164-169, April, 1985. 3 Fig, 45 Ref.

Descriptors: *Chemical speciation, *Marine pollution, *Bioaccumulation, Heavy metals, Organic compounds, Mercury, Lead, Bioassay, Bioavailability.

The realization of the importance of chemical speciation in marine pollution studies has brought chemists and biologists together such that not only can the chemical and geochemical behavior of a pollutant be evaluated but this can be linked to the extent of toxicological effect of the predominant species of the contaminant. This combination of chemical and biological understanding is an essential prerequisite of predictive modelling of the biological impact of pollutants. The chemical cycling of mercury in the environment is used as an example of the concept of chemical speciation. The primary barrier between an organism and its environment is the cell membrane. The toxicity of many agents is related therefore to their lipid solubility and thus to their ability to pass through the lipoprotein membrane of the cells. Since the lipid-soluble species tend to be retained in the membranes and fatty tissues of organisms, bioavailable compounds also are very often accumulated. Various carrier species in the membrane serve to facilitate the passage of molecules and ions. Also the organism/water boundary represents an interface where the surfactant properties of the transported moiety will determine to some extent its bioavailability. Experimental investigations of bioavailability are reported for heavy metals, and organic compounds. Methods used in the measurement of chemical speciation are discussed including physiochemical methods, electrochemical methods, and bioassay. (Baker-IVI)
W86-00600

EFFECT OF PH ON METHYL MERCURY PRODUCTION AND DECOMPOSITION IN LAKE SEDIMENTS,
Manitoba Univ., Winnipeg. Dept. of Microbiology
P. S. Ramlal, J. W. M. Rudd, A. Furutani, and L. Xun.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 685-692, April, 1985. 34 Ref. NRC grant 79-00312.

Descriptors: *Hydrogen ion concentration, *Methyl mercury, *Decomposition, *Lake sediments, Mercury compounds, Ontario, Interstitial water, Methylation, Demethylation, Acidification.

Mercury methylation was measured in surficial sediments taken from unacidified and experimentally acidified lakes in the Experimental Lakes Area, northwestern Ontario. A reduction in the pH of sediments lowered the rate of Hg-203 methylation. Methylation was undetectable at pH < 5.0. This decrease in mercury methylation was probably related to a shortage of available inorganic mercury when the pH of the sediment porewater was reduced. Below pH 6.0, inorganic mercury concentrations in porewater, measured with 203Hg, were reduced to less than 20% of that found at unaltered pH. A comparison of methylation and demethylation rates was made at various pH's. The rate of demethylation decreased to a lesser extent than methylation as the pH was lowered. This research indicates that enhanced mercury methylation in the sediment is not responsible for the observed increase in mercury levels in fish from acidified lakes. (Author's abstract)
W86-00605

NICKEL ACCUMULATION BY SCENEDESMUS AND DAPHNIA: FOOD-CHAIN TRANSPORT AND GEOCHEMICAL IMPLICATIONS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
C. J. Watras, J. MacFarlane, and F. M. M. Morel.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 724-730, April, 1985. 4 Fig, 2 Tab, 42 Ref.

Descriptors: *Nickel, *Bioaccumulation, *Food chains, *Geochemistry, Scenedesmus, Daphnia, Particulate matter, Algal growth, Sediments.

The accumulation of Ni in two levels of a simple aquatic food chain was determined as a function of the concentration of the free metal ion. In NTA-buffered media, Scenedesmus obliquus accumulated Ni to concentrations 30-300 times above ambient. At pNi (= -log Ni(2+) concentration) below 8, algal growth rate declined, cellular Ni quota increased, but no change in the relative size of labile and nonlabile Ni pools was detected. In the same media, Daphnia magna also concentrated Ni but only to levels slightly above ambient. Both short-term (72-h) and long-term (13-d) incubations with D. magna indicated that direct uptake from solution rather than uptake from ingested algae was the primary accumulation vector. There was no biomagnification from the algae to the zooplankton. Ingested particulate Ni was concentrated presumably in fecal matter, which normally sinks to the sediment. (Author's abstract)
W86-00607

5C. Effects Of Pollution

CALCIUM CHLORIDE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
May 1984. 76 p, 27 Fig, 6 Tab, 112 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Calcium chloride, *Chemical spills, *Spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Lakes, Fishkill, Environmental effects, Pollutant identification, Chemical properties, Physical properties.

Information useful for designing countermeasures for calcium chloride spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, suggested countermeasures, and analytical methods. When spilled into water, calcium chloride dissolves rapidly. Mixing in still water is by molecular diffusion; in streams, by turbulence. Nomograms are given for calculating calcium chloride concentrations in nontidal rivers and in lakes. If spilled onto soil, the potential for contamination of groundwater and surface water exists. Nomograms show how calcium chloride travels in coarse sand, silty sand, and clay till. The 4-day median lethal toxicity for aquatic life is $>$ 1000 mg per liter. Fishkills were reported at concentrations of 555 mg per liter (168 hours) to 7752 mg per liter (22 hours). Toxicity studies on fish, frogs, and microorganisms at levels of 84,000 to 22,080 mg per liter are reported. Three methods are suggested for treating water contaminated with calcium chloride: (1) add soda ash and neutralize the clear water with hydrochloric acid, (2) mixed ion exchange, and (3) reverse osmosis.
W86-00309

FERRIC CHLORIDE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
August 1984. 88 p, 22 Fig, 6 Tab, 192 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Ferric chloride, *Chemical spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Rivers, Lakes, Fishkill, Environmental effects, Pollutant identification, Chemical properties, Physical properties.

Information useful for designing countermeasures for ferric chloride spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, previous spill experiences, suggested countermeasures, and analytical methods. When spilled into water, ferric chloride dissolves and mixes rapidly. Mixing takes place by molecular diffusion in still water and by turbulence in streams. Ferric chloride hydrolyzes in all but the most acid waters to form a hydrous ferrous oxide suspension. Nomograms are given for calculating pollutant concentrations in nontidal rivers and in lakes. If spilled onto soil, the potential for contamination of groundwater and surface water exists. Nomograms show how ferric chloride travels in coarse sand, silty sand, and clay till. The 4-day median toxicity for aquatic life has not been determined. Fishkill and fish toxicity data are reported. Effects on microorganisms and invertebrates are reported. Ferric chloride does not biodegrade. It contributes to sludge volume accumulation in water treatment plants. It inhibits sludge digestion in wastewater treatment plants at 500-1000 mg per liter. Ferric chloride spills into water reduce the pH, harming aquatic life. A contaminated water body can be neutralized with a base such as sodium bicarbonate and the resulting precipitate removed by sedimentation or filtering.
W86-00310

CHLORINE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
March 1984. 122 p, 31 Fig, 10 Tab, 8

Descriptors: *Water pollution effects, *Fate of pollutants, *Chlorine, *Chemical spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Rivers, Lakes, Fishkill, Invertebrates, Amphibians, Aquatic animals, Identification, Environmental effects, Pollutant identification, Chemical properties, Physical properties, Activated carbon.

Information useful for designing countermeasures for chlorine spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, suggested countermeasures, previous spill experiences, and analytical methods. When spilled into water, liquid chlorine sinks and boils, producing gaseous chlorine and dissolved toxic materials, including hypochlorous acid and hydrochloric acid. Nomograms are given for calculating chlorine concentrations in nontidal rivers and in lakes. The 4-day median lethal toxicity rating for aquatic life is less than 1 mg per liter. Fishkills have been reported in fresh water at concentrations of 0.3-2.2 mg per liter during exposures up to 4 hr. Fish toxicity studies have been reported for concentrations of 0.07-3.0 mg per liter. Toxicity to invertebrates, zooplankton, amphibians, and microflora are listed for fresh water and salt water. Fish and other aquatic life have been killed and stressed by releases of chlorinated wastewater effluents and chlorinated power plant cooling water. Chlorine degrades rapidly in water, forming chloride as the end product. The behavior of chlorine in sea water is complex. Chlorine released into water may be adsorbed by activated carbon applied at 10% of the spill amount over an area occupied by 10 mg per liter or greater concentration followed by dredging. Chlorine-contaminated soil may be treated by acidification with sulfuric

H 2.0-3.0) followed by reduction with sodium ulfite.
86-00319

ASTAL MARINE RESOURCES INVENTO-, 1983: PEMAQUID POINT TO SPRUCE AD,
ine State Dept. of Marine Resources, West othbay Harbor. Marine Resources Lab.
J. Card, and R. A. Aho.
84). 432 p, 8 Tab, 54 Maps, 305 Ref.

scriptors: *Water pollution effects, *Fate of pol-nts, *Water pollution control, *Marine re-rces, *Oil spills, *Coasts, *Maine, Clams, Inver-rates, Marine animals, Beaches, Shores, Fish, sters, Marinas, Harbors, Aquaculture, Industri-water, Wildlife, Boating, Pemaquid Point, uce Head, Maps, Shellfish.

marine resources of the Main coast were entoried to develop information for oil spill tection and damage assessment. In the coastal from Pemaquid Point to Spruce Head 253 urces were identified which are susceptible to spill damage. These were classified into prior-The soft-shell clam flats (1063 acres with a ding crop of over 48,000 bushels worth $3.6 ion) are considered first priority. Second prior-resources are lobster holding facilities, aquacul-facilities, anadromous fish streams, industrial es, and marinas/boat yards. Priority III is beaches, parks, wildlife preserves, critical s, and natural areas. Priority IV is scenic sites, oric sites, and boat ramps. A user's guide gives ctions for rapid response to an oil spill on the t. The fate of oil in the marine environment the biological effects of oil on various marine nisms (fish and invertebrates) are discussed. -00322

TE: EFFECTS OF THE ORGANOPHOS-TE INSECTICIDE ON BLUEGILLS AND ERTEBRATES IN PONDS,
mbia National Fisheries Research Lab., MO.
. Sanders, D. F. Walsh, and R. S. Campbell.
nical Papers of the U.S. Fish and Wildlife ice, No. 104, 1981. 6 p, 3 Fig, 3 Tab, 11 Ref.

riptors: *Abate, *Insecticides, *Water pollu-effects, *Bluegills, Fish, *Invertebrates, Ponds, anophosphorus pesticides, Ecological effects, wth, Fish physiology, Pesticides, Larvae, Bio-

ication of the organophosphate insecticide e three times (at about monthly intervals) to cate 0.04 ha earthen ponds at 18 g/ha (4 grams/L) - the recommended application - and 180 g/ha (40 micrograms/L) caused no ality of bluegills (Lepomis macrochirus). In s treated with 18 g/ha fewer bluegill fry were uced than in control ponds, brain acetylcho-erase (AChE) activity was not affected, and erated growth of both fry and adults appeared ult from heavy feeding on dead or moribund ra larvae that resulted from each of the first pplications of Abate. In ponds treated with /ha ovary development in bluegills was ini-faster than in bluegills from control ponds, umber of fry produced per female was lower in control ponds (but growth of fry was ected), brain AChE activity in bluegills was gly inhibited after the second and third treat-, and biomass of Diptera in the ponds was ed about 40% but other invertebrates were ected. The routine use of Abate at the recom-ed rate should have little adverse effect on y resources. (Author's abstract)
00341

RCES, CHEMISTRY, FATE, AND EF-'S OF CHROMIUM IN AQUATIC ENVI-MENTS.
gical Analysts, Inc., Sparks, MD.
rimary bibliographic entry see Field 5B.
00344

CTS OF OIL ON AQUATIC ORGANISMS: VIEW OF SELECTED LITERATURE,
Oklahoma State Univ., Stillwater. Water Quality Research Lab.
S. L. Burks.
American Petroleum Inst., Washington, DC. 69 p, 6 Tab, 195 Ref.

Descriptors: *Oil spills, *Reviews, *Water pollution effects, *Oil pollution, *Ecosystems, *Hydrocarbons, *Aquatic animals, *Aquatic plants, Aquatic environment, Oil, Oily water, Algae, Diatoms, Petroleum products.

Spills of light refined oil on aquatic ecosystems will probably cause extensive mortality of sessile species, but mobile species may not be affected unless confined by physical barriers. Most investigations indicate that both freshwater and marine communities are capable of recovering from an oil spill incident within a year. Measured concentrations of petrogenic hydrocarbons in the water column have been reported to range from non-detectable to 60 micrograms/liter. Chemical dispersants may temporarily increase levels of hydrocarbons in the water column, up to 200 micrograms/liter. Low molecular weight aromatic hydrocarbons dissipate rapidly while compounds with low aqueous solubility persist longer after an oil spill. The toxic properties of crude oils appear to be related to the percentage concentration of aromatic hydrocarbons, molecular weight, and aqueous solubility. Except for the 4- and 5-ring polynuclear aromatic hydrocarbons, the relatively lethal effects to marine fish and invertebrates appear to increase from mono-aromatics to alkylated aromatics to dinuclear aromatics. Larvae of fish and most crustaceans appear to be very susceptible to the water soluble fraction of crude oils. Growth of some species of polychaete worms appears to be tolerant. The greatest potential threat to aquatic ecosystems may be the continuous long-term contamination with petroleum hydrocarbons in surface water runoff from urban areas and in wastewater from municipalities in industrial areas.
W86-00349

HAZARDOUS MATERIALS SPILLS-MANAGEMENT REVIEW,
Texas Transportation Inst., College Station.
For primary bibliographic entry see Field 10D.
W86-00350

IMPACT OF XENOBIOTIC CHEMICALS ON MICROBIAL ECOSYSTEMS.
Fish and Wildlife Service, Washington, DC.
Technical Papers, No. 107, 1982. 36 p. Edited by B. Thomas Johnson.

Descriptors: *Water pollution effects, *Ecosystems, *Microorganisms, *Paraquat, *Aquatic populations, *Xenobiotics, *Detritus, *Organic compounds, Ecological effects, Aquatic environment, Environmental impact statement, Pesticides, Herbicides, Microenvironment, Microbiological studies, Industrial wastes, Environmental effects.

These technical papers were presented at the Annual Meeting of the American Society for Microbiology held in Miami Beach Florida in May of 1980. The estimated 70,000 chemical compounds synthesized annually in the United States include such diverse xenobiotics as cyclic intermediates, dyes, organic pigments, medicinal chemicals, flavor and perfume materials, plastic and resin materials, rubber processing chemicals, elastomers, plasticizers, surface-active agents, and pesticides and related products. The question of the hazards of xenobiotics to microbial ecosystems was raised to meeting participants. In response, reports were presented on the potential role of microbial effects testing (environmental risk assessment), the effects of pesticides on non-target microorganisms in agricultural soil, a scheme for microbial toxicity testing of synthetic organic chemicals, and examples of xenobiotic poisoning of specific and non-specific microbial pathways. A method for biochemical determination of biomass and community structure of estuarine detrital and sedimentary microbiota was outlined for use in assessing the effects of xenobiotics. A paper dealing with the cellular mechanisms of paraquat toxicity was also presented.
W86-00352

ENVIRONMENTAL RISK ASSESSMENT: THE POTENTIAL ROLE OF MICROBIAL EFFECTS TESTING,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
J. D. Walker.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 3-5. 1 Tab, 20 Ref.

Descriptors: *Microorganisms, *Microbiological studies, *Aquatic environments, *Growth, *Metabolism, *Water pollution effects, *Bioindicators, *Microbial degradation, Ecological effects, Bacteria, Laboratory tests, Testing procedures, Oxidation-reduction potential, Ecosystems.

Environmental microbiology testing involves assessing the effect of microorganisms and microbial processes on chemical substances and determining the effect of chemical substances on microorganisms and microbial processes. Microbial effects testing may provide a sensitive method for detecting potential environmental perturbations. The use of microbial effects tests might have alerted the Life Sciences Corporation to the problems that resulted from releasing what was probably Kepone, into the Hopewell, Virginia biological treatment plant. Microbial effects tests for measuring decomposition of organic substances have provided sensitive and rapid methods for detecting the effects of smelter emissions on microbial processes in soils. Some representative microbial effects tests provide measurements of growth, product formation, and substrate oxidation, reduction or disappearance. Microbial effects tests may provide sensitive, reproducible, and cost-effective methods for detecting the effects of toxic substances on microorganisms and their activities.
W86-00353

MICROBIAL TOXICITY TESTING OF SYNTHETIC ORGANIC CHEMICALS,
Monsanto Co., St. Louis, MO.
W. E. Gledhill.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 11-14. 2 Tab, 9 Ref.

Descriptors: *Testing procedures, *Water pollution effects, *Microorganisms, *Ecosystems, *Environmental effects, *Ecological effects, *Microbiological studies, Toxins, Water quality standards, Regulations, Environmental protection, Fate of pollutants, Organic compounds.

Federal regulations such as the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act mandate the testing of new chemicals for their toxicity to numerous biological species, including microorganisms. In general microorganisms are less sensitive to xenobiotics than are higher species due to their greater adaptive capabilities, cell wall structure, enzymes and protection afforded by the environment. It was suggested, therefore, that higher organisms be used in initial environmental effects testing and the testing of toxicity to microorganisms be conducted based on initial screening results. A modified TSCA environmental screening program should examine the fate of xenobiotics (mobility and persistence) and the aquatic toxicity to algae, invertebrates and fish. Water quality regulations arising from tests on higher organisms should be sufficiently restrictive to protect microbial populations. At present, there is no consensus as to the best methodology for determination of appppropriate microbial toxicological information. More research is needed in establishing laboratory microcosms to simulate more closely the microbiological processes in the natural environment.
W86-00354

BIOCHEMICAL DETERMINATION OF BIOMASS AND COMMUNITY STRUCTURE OF ESTUARINE DETRITAL AND SEDIMENTARY MICROBIOTA,
Florida State Univ., Tallahassee. Dept. of Biological Science.

D. C. White.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 22-28. 2 Fig, 4 Tab, 34 Ref.

Descriptors: *Biomass, *Marine sediments, *Microorganisms, *Ecosystems, *Testing procedures, *Lipids, *Water pollution effects, *Biochemistry, Ecological effects, Oil pollution, Environmental protection, Metabolism, Estuarine environment, Bioindicators.

Sedimentary microbial biomass, metabolic activity, nutritional status, and community structure were determined by the analysis of extractable lipids and hydrolysis products of the lipid extracted residue in microbial communities in the laboratory or in the field. These methods have been validated by analysis of mixtures of microbial monocultures isolated from microbial assemblies, by measurements of the effects of grazing by selective deposit feeding invertebrates, and by scanning electron microscopic analysis of detrital microbial assemblies manipulated with antibiotics, nutrients, and light. Such methods have shown that milligrams/liter concentrations of xenobiotics in fluids used in oil and gas well drilling can significantly modify the biomass and community structure of microbial assemblies colonizing marine sand. These techniques can also allow estimation of the validity of using microcosm test systems to determine the impacts of xenobiotics in the field. These methods could greatly strengthen the legal applicability of data used by regulatory agencies in protecting estuarine environments.
W86-00355

CELLULAR MECHANISMS OF PARAQUAT TOXICITY,
Columbia National Fisheries Research Lab., MO.
M. Heitkamp, and O. R. Brown.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 29-36. 4 Fig, 5 Tab, 40 Ref.

Descriptors: *Paraquat, *Escherichia coli, *Growth, *Rodents, *Defoliants, *Water pollution effects, *Lethal limit, *Pesticide toxicity, Herbicides, Bacteria, Microorganisms, Pesticides, Toxins, Amino acids, Agricultural chemicals, Fish, Mammals, Mortality, Toxicity.

Paraquat (1,1'-dimethyl-4,4'-bipyridylium ion), a non-selective contact defoliant and herbicide is toxic to various organisms, including man. Oxygen radicals are reportedly generated in tissues by paraquat; thus there is a potential link between the mechanisms of poisoning by paraquat and hyperbaric oxygen. A study was undertaken of specific sites of paraquat toxicity, using bacteria and rats. Specific amino acids and niacin partly protected Escherichia coli from the bacteriostatic effects of 1mM paraquat. The amino acids appeared to protect the bacteria because aerobic paraquat poisons the same pathways of amino acid biosynthese previously found to be sensitive to hyperbaric oxygen. Specifically, dihydroxyacid dehydratase, which is required for branch-chain amino acid biosynthesis, was poisoned in cells exposed to paraquat. Niacin further protected E. coli against growth inhibition and specifically against the decrease in nicotinic acid adenine dinucleotide (NAD) that otherwise occurred. NAD was decreased because paraquat apparently poisoned the same enzyme (quinolinate phosphoribosyl transferase) that was previously reported to be poisoned by hyperbaric oxygen. Niacin gave significant protection to rats injected with lethal amounts of paraquat; the time to LT50 was increased from 60 to 115 h, and the percentage of animals surviving for 1 week was increased from 20 to 45 in a study with four groups of 25 animals each. (Author's abstract)
W86-00356

CHEMICAL CONTAMINANTS AND ABNORMALITIES IN FISH AND INVERTEBRATES FROM PUGET SOUND,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. C. Malins, B. B. McCain, D. W. Brown, A. K. Sparks, and H. O. Hodgins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-11518 8. NOAA Technical Memorandum OMPA-19, June 1982. 168 p. 44 Fig, 42 Tab, 108 Ref, Append.

Descriptors: *Invertebrates, *Water pollution effects, *Fish, *Hydrocarbons, Polychlorinated biphenyls, Water pollution effects, Pollutants, *Puget Sound, Liver, Metals, Lead, Arsenic, Mercury, Sediments, Urban areas, Rural areas, Washington.

Samples of sediment and selected bottom-dwelling fish and invertebrates were collected at regular intervals from 1978 to the spring of 1981 from urban and rural areas of Puget Sound. The concentrations of aromatic hydrocarbons (AH), polychlorinated biphenyls (PCB) and chlorinated butadienes were widely distributed in sediment from Puget Sound with the highest concentrations in Commencement Bay and Elliott Bay. Arsenic and mercury were only detected in sediment from urban areas, whereas lead was high in both urban (130,000 ppb, dry weight) and rural (15,000 ppb, dry weight) sediments. All of the above chemicals were detected in higher concentrations in biota from urban areas. Bottom fish, crabs, and shrimp had a variety of pathological conditions. In English sole, the fish species most widely distributed throughout Puget Sound, liver neoplasms, preneoplastic and necrotic liver lesions were correlated with sediments having high concentrations of metals and AH.
W86-00358

EFFECTS OF TOXICANTS ON PLANKTON,
Environmental Research Lab., Gulf Breeze, FL.
G. E. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117044. Report EPA-600/D-82-338, 1982. 67 p. 216 Ref.

Descriptors: *Industrial wastes, *Toxic wastes, *Municipal wastes, *Plankton, Algae, Heavy metals, Pesticides, Toxicity, Pollutants, Pollution effects, Growth inhibition, Oil pollution, Zooplankton, Larvae, Eggs, Crustaceans, Sediments, Dredging.

The effects of heavy metals, pesticides, and industrial and municipal wastes on holo- and meroplankton in the field and laboratory are reviewed. Th most commonly measured response of unialgal cultures to pollutants is growth inhibition. Reports in recent years have included descriptions of the effects of pollutants on morphology, physiology and population interactions. Algae are more sensitive to industrial and municipal wastes, but more resistant to single pollutants, than animals.
W86-00360

CHLORINATED HYDROCARBONS AS A FACTOR IN THE REPRODUCTION AND SURVIVAL OF LAKE TROUT (SALVELINUS NAMAYCUSH) IN LAKE MICHIGAN.
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
Technical Papers of the U.S. Fish and Wildlife Service, No. 105, 1981. 6 p, 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Lake Michigan, *Water pollution effects, *Trout, Lakes, *DDE, *Halogenated pesticides, *Pesticide toxicity, *Polychlorinated biphenyls, *Aroclors, Pesticides, Fish eggs, Hatching, Incubation, Growth, Metabolism, Fish populations, DDT, Ecological effects, Fish behavior, Hydrocarbons, Larvae, Michigan.

Although lake trout (Salvelinus namaycush) were considered extinct in Lake Michigan by the mid 1950's, control of the parasitic sea lamprey (Petromyzon marinus) and extensive restocking resulted in an abundance of hatchery-produced lake trout by the early 1970's. However, no naturally produced yearling or older lake trout have been found in the lake in nearly a decade of sampling. It was hypothesized that DDT and its metabolites and polychlorinated biphenyls (PCB's) in lake waters may adversely affect the hatchability and survival of larval fish. However, manually stripped and fertilized trout eggs have hatched successfully and the fry have survived normally under a va hatchery conditions. A series of studies we ducted at the Great Lakes Fishery Laborat the effects of chlorinated hydrocarbons reproduction and survival of Lake Trout Michigan. Specific investigations examin comparative hatchability of lake trout egg different conditions of contaminant burd incubation, and the effects of chronic expo PCB's and DDE on growth and mortality swimming performance of young lake tro nerability of young lake trout to predatic temperature selection by young lake trout. tory and field studies on the effects of c nants on the biochemistry and metabolism trout were also conducted.
W86-00363

INTRODUCTION AND SUMMARY,
National Marine Fisheries Service, Ann MI. Great Lakes Fishery Lab.
W. A. Wilford, R. A. Bergstedt, W. H. Berl R. Foster, and R. J. Hesselberg.
In: Technical paper of the U.S. Fish and Service, No. 104, 1981, p 1-7. 24 Ref.

Descriptors: *Lake Michigan, *Water pollu fects, *Trout, *Pesticides, *DDE, *Pesticid ity, *Polychlorinated biphenyls, *A Growth, Metabolism, Fish eggs, Fish popu Hydrocarbons, Halogenated pesticides, Ec effects, Fish behavior, Michigan.

Studies were performed at the Great Lake ery Laboratory on the performance and sur fry hatched from eggs of Lake Michigan la and exposed for 6 months to PCB's (Aroclo and DDE at concentrations similar to present in offshore waters and zooplank Lake Michigan (10.0 nanograms/liter PCl 1.0 nanograms/liter DDE in water; 1.0 grams/g PCB's and 0.1 micrograms/g D food), and at concentrations 5 and 25 times Cumulated mortality of the exposed fry was twice that of unexposed controls. Evaluat the growth, swimming performance, p avoidance behavior, temperature preferen metabolism of the fry showed no significant attributable to exposure to PCB's and except for a lowering of preferred tempera the highest exposure level for each cont and additively when both contaminants we bined. Although several factors undoubted tributed to the lack of recruitment of n produced lake trout in Lake Michigan, th of PCB's and DDE present during the early 1970's were sufficient to significantly redu vival of any fry produced in the lake and impede restoration of the lake trout popul self-sustainability.
W86-00364

COMPARATIVE HATCHABILITY OF TROUT EGGS DIFFERING IN CON NANT BURDEN AND INCUBATION C TIONS,
National Marine Fisheries Service, Ann MI. Great Lakes Fishery Lab.
M. J. Mac, W. H. Berlin, and D. V. Rottiers
In: Technical Papers of the U.S. Fish and Service, No. 104, 1981, p 8-10. 1 Fig, 2 Tab

Descriptors: *Lake Michigan, *Water pollu fects, *Hatching, *Trout, *Fish eggs, *Pol nated biphenyls, *DDE, *Pesticides, *A Larvae, Hydrocarbons, Chlorinated hydroc Halogenated pesticides, Ecological effects, ity, Lakes, Michigan.

In 1972, fertilized eggs of lake trout (Sa namaycush) from the Marquette (Michiga Fish Hatchery (where levels of contamina relatively low) and eggs from lake trout c in Michigan waters of Lake Michigan near tuck and Charlevoix (where levels of PC DDE are elevated) were incubated at h temperatures (6 degrees) and at temperatur lating the natural temperature cycle o Michigan (1-8 degrees). Survival to yolk tion of larvae from these three sources rang

to 65.5%, and no correlation was observed
ween survival and the level of PCB's and DDE
he eggs. Additional studies in 1975 with lake
t eggs from the same three sources confirmed
ious observations that the elevated levels of
's and DDE in eggs from Lake Michigan did
appear to affect the percent hatch of lake trout
or survival of the fry to the swim-up stage.
n fry hatched from eggs with an elevated
aminant burden were starved for several
ks, no abnormal increase in posthatching mor-
y during the period when the yolk stores were
g consumed was observed. (Author's abstract)
-00365

**WTH AND MORTALITY OF FRY OF
E MICHIGAN LAKE TROUT DURING
RONIC EXPOSURE TO PCB'S AND DDE,**
onal Marine Fisheries Service, Ann Arbor,
Great Lakes Fishery Lab.
. Berlin, R. J. Hesselberg, and M. J. Mac.
echnical Papers of the U.S. Fish and Wildlife
ice, No. 104, 1981, p 11-22. 2 Fig, 8 Tab, 37

riptors: *Water pollution effects, *Polychlori-
l biphenyls, *DDE, *Pesticides, *Growth,
ut, *Mortality, *Bioaccumulation, Aroclors,
rocarbons, Halogenated pesticides, Lakes,
e Michigan, Fish, Michigan.

hatched from eggs of Lake Michigan lake
were chronically exposed to concentrations
B's and DDE similar to those found in water
lankton in southeastern Lake Michigan (LX)
o concentrations 5 (5X) and 25 (25X) times
er. Body levels of contaminants in fry de-
ed at 1X level of PCB's and at 1X and 5X
of DDE, but generally increased at all other
minant exposure levels. PCB and DDE
e was evident from increased body burdens
e contaminants at all exposure levels and in
ntrols. Growth was not significantly affected
y of the contaminant exposure levels. Mor-
s of fry exposed to the 1X and 5X contami-
levels were significantly less than those of
ol fry before day 56. Between days 57 and
mortality rates increased rapidly and were
cantly higher in all exposed groups than in
ntrol group. Although mortality was lower
last 40 days of exposure, it continued to be
cantly higher in all exposed fry than in con-
except those in the 1X and 5X PCB groups.
e end of the 176-day study, the total cumula-
nortality ranged from 30.5 to 46.5% in the
ed groups and was 21.7% in the control
.
00366

**IMING PERFORMANCE OF YOUNG
TROUT AFTER CHRONIC EXPOSURE
B'S AND DDE,**
al Marine Fisheries Service, Ann Arbor,
reat Lakes Fishery Lab.
Rottiers, and R. A. Bergstedt.
chnical Papers of the U.S. Fish and Wildlife
e, No. 104, 1981, p 23-28. 2 Fig, 3 Tab, 9

ptors: *Fish behavior, *Water pollution ef-
*Polychlorinated biphenyls, *Pesticides,
, *Aroclors, *Trout, *Halogenated pesti-
*Ecological effects, Lakes, *Lake Michigan,
carbons, Fish populations, Michigan.

ning performance was measured in fry of
out hatched from Lake Michigan fish. The
ere exposed for 50, 110, and 165 days to
DDE, and a combination of these two
inants in both food and water at concentra-
qual to, and 5 and 25 times higher than
found in Lake Michigan water and plankton.
ning performance was assessed by forcing
to swim through a continuous series of
entally increased velocities until the fish
xhausted. Although significant differences in
ing performance were observed between a
st groups, no relation between swimming
nance of the fry and exposure to PCB's or
or both was noted at the concentrations
Inasmuch as swimming performance appar-
ently was not affected by the levels of contamination by PCB's and DDE in Lake Michigan, impairment of swimming by these contaminants cannot account for the failure of lake trout reproduction in Lake Michigan.
W86-00367

VULNERABILITY OF YOUNG LAKE TROUT TO PREDATION AFTER CHRONIC EXPOSURE TO PCB'S AND DDE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
M. J. Mac.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 29-32. 3 Tab, 10 Ref.

Descriptors: *Fish populations, *Trout, *Lake Michigan, *DDE, Polychlorinated biphenyls, *Predation, *Fish behavior, *Water pollution effects, Lakes, Pesticides, Aroclors, Ecological effects.

The vulnerability of fry of Lake Michigan lake trout (Salvelinus namaycush) to predation by rainbow trout (Salmo gairdneri) was tested after the fry had been exposed to PCB's, DDE, and a combination of these contaminants in both water and food at concentrations corresponding to ambient levels (1X) in water and plankton in Lake Michigan and at levels 5 and 25 times higher. Vulnerability of the fry, measured as the ratio of escapes to predator attacks, was not significantly increased by either 90 or 165 days of exposure to the contaminants at any of the concentrations tested, and no behavioral differences were observed between control and exposed fry in their reaction to predators. Exposure to PCB's and DDE at environmental and higher concentrations thus did not affect the vulnerability of lake trout fry to predation. This observation suggests that the failure of lake trout reproduction in Lake Michigan was not caused by contaminant-induced reductions in the ability of the fry to escape predators. (Author's abstract)
W86-00368

TEMPERATURE SELECTION BY YOUNG LAKE TROUT AFTER CHRONIC EXPOSURE TO PCB'S AND DDE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
M. J. Mac, and R. A. Bergstedt.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 33-35, 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Polychlorinated biphenyls, *DDE, *Water temperature, *Pesticides, *Fish behavior, *Trout, *Ecological effects, *Lake Michigan, Survival, Lakes, Fish populations, Halogenated pesticides, Aroclors, Michigan.

Temperature selection tests were conducted with fry of Lake Michigan lake trout (Salvelinus namaycush) exposed to PCB's, DDE and a combination of these contaminants in food and water at levels 25 times the ambient levels in plankton and water in Lake Michigan. Fry were placed in a vertical temperature gradient tank which was checked for dissolved oxygen concentration along the gradient to exclude the possibility of gas bubble disease. The tank was also checked for the possibility of N2 supersaturation by confining yearling yellow perch in the warmest surface layers for 1 wk, but no signs of gas bubble disease were detected. Results showed that exposure of fry to PCB's and DDE lowered their preferred temperature. After 98 days of exposure, mean preferred temperatures were 10.3 degrees for fry exposed to PCB's 9.8 degrees for fry exposed to DDE, and 8.7 degrees for those exposed to PCB's plus DDE, as compared with 11.2 degrees for control fry. Frequency distributions of residence temperatures were significantly different among all treatments. Such a change in the preferred temperature caused by a contaminant could reduce the energetic efficiency of a fish and thereby reduce growth and survival.
W86-00369

BIOCHEMISTRY AND METABOLISM OF LAKE TROUT: LABORATORY AND FIELD STUDIES ON THE EFFECTS OF CONTAMINANTS,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
D. R. M. Passino.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 36-42. 4 Tab, 39 Ref.

Descriptors: *Lake Michigan, *Trout, *Water pollution effects, *Enzymes, *Pesticides, *DDE, *DDT, *Polychlorinated biphenyls, *Metabolism, Ecological effects, Fish, Fish behavior, Aroclors, Halogenated pesticides, Michigan.

Several biochemical indicators of stress were measured in fry of Lake Michigan lake trout exposed to PCB's (Aroclor 1254) and DDE in food and water and in unexposed fry. No difference in treatments were observed in oxygen consumption rates of lactate concentrations of unexercised fry, but apparent differences in specific swimming speed and lactate response in fry that swam to exhaustion suggested that exposed fry had lower stamina. Observed differences between biochemical profiles of 1-day-old sac fry reared from eggs of lake trout collected off Saugatuck and those originating from eggs of brood stock at the Marquette (Michigan) hatchery may have been caused by organochlorine contamination or by genetic and dietary differences between parental stocks. Activity of allantoinase was measured in juvenile and adult trout as an indicator of sublethal effects of Great Lakes contaminants. The 50% inhibition of allantoinase in vitro occurred at 6.0 mg/liter Cu(++), 6.7 mg/liter Cd(++), 34 mg/liter Hg(++), and 52 mg/liter Pb(++). In vivo exposure to PCB which cause accumulations of 2.6 micrograms/g (whole fish) activated allantoinase slightly to the 10% significance level. Allantoinase activity was negatively correlated with total length for fish from Lake Michigan but not for fish from Lake Superior or from laboratory stocks. Hg, PCB's and DDT, acting in combination or with other contaminants may be the cause of the negative correlation of allantoinase activity with size in Lake Michigan lake trout.
W86-00370

EFFECT OF CADMIUM AND ZINC ON INTESTINAL ABSORPTION OF XYLOSE AND TRYPTOPHAN IN THE FRESH WATER TELEOST FISH, HETEROPNEUSTES FOSSILIS,
D.A.V. Coll., Muzaffarnager (India). Dept. of Zoology.
K. V. Sastry, and S. Subhadra.
Chemosphere, Vol. 13, No. 8, p 889-898, 1984. 4 Tab, 24 Ref.

Descriptors: *Fish, *Xylose, *Tryptophan, *Cadmium, *Zinc, Toxicity, Heavy metals, Nutrients, Water pollution effects.

Two experimental conditions were used to study the effect of cadmium and of zinc on the rate of uptake of a pentose sugar xylose and an aminoacid tryptophan by the intestine of a teleost fish, Heteropneustes fossilis. In the first experimental condition four concentrations of cadmium or zinc (1.0, 0.1, 0.01 or 0.001 mM) mixed with the nutrient solution were placed in the intestinal sacs and the rate of absorption was recorded after 1 hr at 23 C. In the second experiment the fish were exposed by bath to a sublethal concentration of cadmium (0.26 mg/l) or zinc (4 mg/l) for 15 min and 30 days and the rate of absorption of the two nutrients measured. The presence of cadmium or zinc in the intestine or in the ambient water can decrease the rate of transport of xylose and tryptophan and the activity of intestinal brush border Na(+), K(+) ATPase. The rate of absorption of each of the two nutrients is inversely related to the concentration of each of the two heavy metals in the instilled solution and to the period of exposure of test fish to the heavy metals. Higher concentrations of both the heavy metals decreased nutrient absorption rates to a greater extent than do lower concentrations in vitro. The decreases were most marked between 0.01 and 0.001 mM of cadmium or zinc. Thirty days exposure to each heavy metal in vivo

produced a greater decrease in the rate of absorption of the two nutrients than did exposure for 15 days. Heavy metals may also bind to the proteins of the brush border membrane of the mucosal cell and thus alter their permeability. (Baker-IVI)
W86-00390

OCCURRENCE OF R-PLASMIDS IN ESCHERICHIA COLI AND COLIFORM GERMS FROM WATER AND WASTEWATER; PART 2: METHODS OF ISOLATION OF R+ -BACTERIA FROM SURFACE AND WASTEWATER, THE TRANSFER OF THEIR R-PLASMIDS AS WELL AS THE DETERMINATION OF THE RESISTANCE IMAGES (UBER DAS VORKOMMEN VON R-PLASMIDEN IN ESCHERICHIA COLI UND KOLIFORMEN KEIMEN AUS WASSER UND ABWASSER; TEIL 2: METHODEN DER ISOLIERUNG VON R+ - BACTERIEN AUS OBERFLACHEN - UND ABWASSER, DES TRANSFERS IHRER R-PLASMIDE SOWIE DIE BESTIMMUNG DER RESISTENZ-BILDER),
Institut fur Experimentelle Epidemiologie, Wernigerode.
For primary bibliographic entry see Field 5D.
W86-00398

'MAN AND BIOSPHERE' - STUDIES ON SIKKIM HIMALAYAS. PART 2: ACUTE TOXICITY OF MIXED COPPER-ZINC SOLUTIONS ON COMMON CARP, CYPRINUS CARPIO (LINN.),
Delhi Univ. (India). Dept. of Anthropology.
B. S. Khangarot, A. Sehgal, and M. K. Bhasin.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 131-145, 1984. 3 Tab, 17 Ref.

Descriptors: *Copper, *Zinc, *Toxicity, *Carp, Fish, Water pollution effects, Heavy metals, Synergism.

A study was made of the effects of Cu-Zn mixtures to determine whether the acute toxicities of Cu and Zn are synergistic or antagonistic in the common carp, Cyprinus carpio. In batch experiments for 6 to 48 hr, individuals of C. carpio were exposed to mixed solutions of copper and zinc sulfate: pH = 6.3, temperature 15 C, 6.8 mg/l oxygen, 7.1 mg/l Ca(2+), 0.7 mg/l Mg(2+). The LC50 for the individual substances on exposures of 24 and 48 hr amounted to 9.04 and 7.28 mg/l for zinc and 0.11 and 0.095 mg/l for copper. The sum of the biological activity of the two kinds of metal ions is assessed according to Marking's index: at low concentrations of the mixed solutions the two metals show an additive effect, at higher concentrations a synergistic effect occurs. (Baker-IVI)
W86-00404

TOXICITY OF THE HERBICIDE 2,4-D-NA TO TWO SPECIES OF FRESHWATER PRAWN OF THE GENUS MACROBRACHIUM,
Gorakhpur Univ. (India). Dept. of Zoology.
Omkar, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 285-289, 1984. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Toxicity, *Herbicides, *Prawn, *Dichlorophenoxy acetic acid, Organic compounds, Pesticide toxicity, Water pollution effects.

The herbicide 2,4-D-Na (the sodium salt of 2,4-dichlorophenoxy acetic acid) is commonly used in eastern Uttar Pradesh (India); as a consequence of its use, the herbicide ultimately finds its way to the aquatic environment through runoff water and affects aquatic life. In batch experiments with exposure for 24 to 96 hr Macrobrachium naso and M. dayanum were exposed to solutions of 2,4-D-Na. The LC50,96 hr are 2.397 g/l for M. naso and 2.275 g/l for M. dayanum. No mortality was observed in solutions of 2.1 and 1.85 g/l. The differences in toxicity are not dependent on the size of the organisms, but they are species-specific. The toxicity reactiions to 2,4-D-Na were seen earlier in M. dayanum than M. naso even at the same concentrations. The specimens became excited, showed erratic swimming and attempted to jump out of the test container. Violence was seen next, followed by paralysis and death. (Baker-IVI)
W86-00413

EFFECT OF ALDRIN ON THE CARBOHYDRATE METABOLISM OF A FRESHWATER PRAWN MACROBRACHIUM LAMARREI (H.-M. EDWARDS) CRUSTACEA, DECAPODA,
Gorakhpur Univ. (India). Dept. of Zoology.
Omkar, R. Murti, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 549-552, 1984. 1 Tab, 19 Ref.

Descriptors: *Pesticides, *Toxicity, *Prawn, *Aldrin, Water pollution effects, Organic compounds, Aldrin, Metabolism, Pesticide toxicity.

The acute toxicity of aldrin to freshwater prawn was studied with particular attention to biochemical and physiological changes induced by aldrin. Aldrin had a marked effect on hepatic glycogen of Macrobrachium lamarrei. The decrease in the glycogen content was observed in all the three concentrations after each exposure which showed a time- and dose-dependent relation. The decrease in hepatic glycogen was more significant in the lowest concentration after 48 and 72 hr and highly significant in two higher concentrations up to 72 hr and in all the three concentrations after 96 hr of exposure. The blood glucose level was decreased significantly in 0.017 and 0.021 mg/l aldrin after 24 hr. The decrease in blood glucose increased with an increase in the concentration of aldrin. A rise in the glucose level was observed after 48 and 72 hr of exposure, which was more significant in two higher concentrations after 48 hr and in the lowest concentration after 72 hr exposure. The decrease in the blood glucose level after 96 hr exposure was significant at $P<0.05$, $P<0.01$, and $P<0.001$ in solutions of 0.008, 0.017, and 0.021 mg/l, respectively. The depletion in blood glucose within 24 hr of aldrin exposure indicates that the blood glucose has been used to meet the energy requirement due to the stress. (Baker-IVI)
W86-00421

'MAN AND BIOSPHERE' - STUDIES ON THE SIKKIM HIMALAYAS. PART 3: ACUTE TOXICITY OF MIXTURES OF ENDRIN AND CALAXIN ON THE TADPOLE LARVAE OF THE FROG RANA HEXADACTYLA,
Delhi Univ. (India). Dept. of Anthropology.
B. S. Khangarot, A. Sehgal, and M. K. Bhasin.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 563-565, 1984. 2 Tab, 12 Ref.

Descriptors: *Water pollution effects, *Toxicity, *Frogs, Endrin, Calaxin, Pesticides, Organic compounds, Tadpoles, Immature growth stages, Synergism.

The knowledge of the toxicity of mixtures is important, because interactions may increase or decrease the toxicity depending upon the properties of the pollutants. Further, a toxicant never occurs singly in polluted waters but is always found in mixtures. The acute toxicities of mixtures of endrin and calaxin on tadpoles of the frog Rana hexadactyla for 48 hr exposures were investigated. The LC50s and 95% confidence limits of individual insecticides at 48 hr exposures indicate that calaxin was more toxic than endrin. The sum of the biological activity of the two toxicants is 1.235, the toxicity is less than additive. A combination of endrin and calaxin (1:1) produced an additive index of -0.235, which suggests a less than additive toxicity. The 2:1 and 1:2 ratios (endrin:calaxin) were synergistic. (Baker-IVI)
W86-00422

SENSITIVITY OF SOUTHERN QUEBEC LAKES TO ACIDIC PRECIPITATION,
Quebec Univ., Sainte-Foy.
M. Lachance, B. Bobee, and Y. Grimard.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 115-132, June, 1985. 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Acid rain, *Quebec, *Lakes, Water pollution effects, Physicochemical properties, Acidity, Sulfates, Lithology, Seasonal variation, Spatial distribution, Mineralization, Canadian Shield.

Physico-chemical data from 258 Quebec l
lected during spring and summer 1980 a
med in order to obtain a first general dia
lake acidification in Quebec. The spatial
of the mineralization of lakes is interp
relation to lithology and glacial deposits,
the identification of Canadian Shield area
larly threatened by acid precipitation.
lakes may be classified into two groups v
or low sensitivity to acidification, acco
their location on either the Canadian Shi
the Appalachian area. The study of th
distributions of conductivity and alkalini
has allowed the identification of Shield a
ticularly sensitive to acid precipitation. T
west to north-east gradient in the concen
sulfate indicates the importance of long
mospheric transport of S and suggests th
levels have substantially increased in
Quebec lakes. The frequency distributio
values and the existence of a relation bet
and sulfate concentrations suggest that m
on the southern part of the Shield are
affected by acid precipitation. Data obtain
spring from some Shield lakes show a s
decrease in pH and alkalinity during th
compared to summer values, and demon
importance of these atmospheric episodic
sensitive lakes. (Baker-IVI)
W86-00427

RESPONSE OF CLIMBING PERCH, A TESTUDINEUS TO INDUSTRIAL P ANTS: HEAD KIDNEY PEROXIDASE, PEROXIDASE, AND BLOOD THY PROFILES,
Visva-Bharati Univ., Santiniketan (India). mental Toxicology Lab.
S. Chatterjee, and S. Bhattacharya.
Water, Air, and Soil Pollution, Vol.25, 161-174, June, 1985. 7 Fig, 5 Tab, 29 Ref.

Descriptors: *Water pollution effects, *Fi oxidase, Phenols, Industrial wastes, Mercu ride, Cadmium chloride, Ammonia, perch, Perch.

Climbing perch, Anabas testudineus, were under static conditions to nonlethal conce of HgCl2 (0.166 ppm as HgCl2), CdCl ppm as CdCl2), phenol (21.11 ppm as ph NH3 (54 ppm as NH3) for 2 days and th ferred to toxicant free water for 30 days. also treated chronically for 30 days with of these toxicants containing 0.083 ppm 66.66 ppm CdCl2, 6.66 ppm phenol and NH3. A chronic test for 30 days was also ed with a factory effluent collected from gapur Industrial Complex. A distinct role of phenol, NH3, Cd, and Hg mixtu toxicants and factory effluent was establis only is the enzyme inhibited during th exposure tests but also the decrement long after transfer of fish to toxicant fr Inhibition of peroxidases may result in the tion of the enzymes concerned with per tabolism and changes in the lipid per pathways. Peroxidase activity from hea was estimated in fish treated with certai ual toxicants, mixture of toxicants and effluent, in all of which 100% survival o recorded. In all these treatments, signific tion of the enzyme was obtained. Consic role of peroxidase in peroxide metabolis tion of the enyzme (GPOD) may cause the chain of events. This may lead to a imbalance in the homeostatis of the (Baker-IVI)
W86-00429

EFFECT OF SIMULATED SULFUR RAIN ON THE CHEMISTRY OF A S ADSORBING FOREST SOIL,
Pacific Northwest Environmental Resea Corvallis, OR.
J. J. Lee.
Water, Air, and Soil Pollution, Vol. 25, 185-193, June, 1985. 4 Tab, 9 Ref.

escriptors: *Acid rain, *Water pollution effects, Forest watershed, *Soil chemistry, Adsorption, lfates, Nitrates, Calcium, Magnesium, Hydrogen n concentration, Zinc.

cidic deposition can potentially acidify unman-ed forest soils, leading to reduced productivity, e mortality, and acidification of surface waters. mulated sulfuric acid rain (pH 3.0, 3.5, 4.0) or ntrol rain (pH 5.6) was applied for 3.5 yr to large simeter boxes containing a sulfate-adsorbing rest soil and either red alder or sugar maple edlings. Elevated sulfate concentrations caused the simulated sulfuric acid rain were most pro-unced for the top 15 cm, but extended down to cm (maple) or 75 cm (alder). No effects of fate concentrations were noted at depths of 75 90 cm, confirming the existence of a sulfate nt between 20 cm and 100 cm. Decreases in Mg d Ca concentrations, base saturation, and soil H re limited to the uppermost 15 cm and, in most es, to the pH 3.0 treatment. Concentration of g and Ca for the pH 3.0 treatments were greater n control at a depth of 15 to 30 cm, indicating nsport of the cations from the soil surface. Na d K concentrations, and cation exchange capac-, were not affected by simulated sulfuric acid n. Elevated concentrations of nitrate and ex-ctable zinc throughout the alder systems indi-e either increased rates of symbiotic N-fixation decreased rates of N immobilization; and mobili-ion of Zn by all acid rain treatments. Acid osition at rates typical of the most highly im-ted region apparently can cause accelerated s of bases in the top 15 cm of soil in some sumably insensitive ecosystems. (Baker-IVI)
6-00430

OMASS AND STRUCTURE OF PHYTO-ANKTON IN KONIN LAKES IN THE ARS 1976-1980,
ish Academy of Sciences, Lomianki. Inst. of logy.
podniewska.
logia Polska, Vol. 32, No. 2, p 289-305, 1984. 4 , 5 Tab, 10 Ref.

criptors: *Biomass, *Konin Lakes, *Poland, kes, *Phytoplankton, *Thermal pollution, er pollution effects, Thermal powerplants, er cooling, Heated water, Algae, Diatoms, Eu-hication.

mass and qualitative structure of phytoplankton e investigated in 4 heated lakes of the cooling em of Konin and Patnow thermal power sta-s. The lakes joined the cooling system at differ-times. The lakes vary in morphometry, turbu-e, flow and intensity of the effect of heated er. The temperature of surface water in mer reaches the maximum of 27 C. No basic erences were observed in the phytoplankton nass in lakes varying as to the length of time er the influence of heated water. The greatest toplankton biomass was recorded in shallow lawskie Lake in summer 1979. Mean phyto-kton biomass between May and September was also highest in Goslawskie Lake, about 6 liter, and the lowest in the deepest lakes: Sle-kie and Mikorznskie (about 4 mg/l). In deep s intensive water blooms were not observed. ing summer the phytoplankton biomass of e lakes ranged between 1 and 12 mg/l. The ity of planktonic algae was very small in er despite the high temperature of the water. oms dominated in the plankton of all lakes, but percentage in total phytoplankton biomass of cular lakes differed considerably. Undoubted-e heating of Konin lakes results in great num-of species of green algae in the phytoplankton. constrained flow of water, especially in Li-skie Lake, and water turbulence, do not create ble condition for the intensive growth of this p of algae and for gradual substitution of oms by green algae and then by blue-green e. Under the conditions in the Konin lakes, the t water mobility is undoubtedly a factor limit-intensive phytoplankton growth. (Baker-IVI)
-00438

ECT OF ZINC ON CADMIUM TOXICITY THE AMPHIPOD GAMMARUS PULEX,
Newcastle upon Tyne Univ. (England). Dept. of Zoology.
R. Howell.
Hydrobiologia, Vol. 123, No. 3, p 245-249, April, 1985. 3 Fig, 3 Tab, 23 Ref.

Descriptors: *Cadmium, *Toxicity, *Amphipods, *Zinc, *Estuarine environment, Water pollution effects, Heavy metals.

Because aquatic invertebrates are often exposed to increased concentrations of more than one toxic metal in the environment, antagonism between toxic metals may occur. Gammarus pulex were collected from sites in Northumberland, England and analyzed for total body zinc and cadmium concentrations. The toxicity of cadmium to animals from the different sites was compared with the initial total body zinc and cadmium concentrations of the animals from the site. The toxicity of cadmium to G. pulex was related to the initial total body zinc concentration but not to the initial total body cadmium concentration. In low zinc animals the susceptibility to cadmium poisoning was reduced by exposing the animals to a low concentration of zinc for 14 days. (Baker-IVI)
W86-00446

CONCORDANT VARIATION IN THERMAL TOLERANCE AND ALLOZYMES OF THE RED SHINER, NOTROPIS LUTRENSIS, INHABITATING TAILWATER SECTIONS OF THE BRAZOS RIVER, TEXAS,
North Texas State Univ., Denton. Dept. of Biological Sciences.
T. L. King, E. G. Zimmerman, and T. L. Beitinger.
Environmental Biology of Fishes, Vol. 13, No. 1, p 49-57, May, 1985. 1 Fig, 2 Tab, 43 Ref.

Descriptors: *Shiners, *Thermal pollution, *Thermal tolerance, *Allozymes, *Tailwater, *Brazos River, *Texas, Water pollution effects, Genetics, Dam effects, Stream regulation, Enzymes.

Critical thermal maxima (CTM) and genetic variation were compared for red shiners, Notropis lutrensis, from regulated and unregulated sites on the Brazos River in northcentral Texas. Tailwater fish acclimated to 25 C had significantly lower CTM's than those from a site upstream from the dam and unregulated downstream sites. Significantly different intrasite variances were observed, with two- and four-fold larger CTM variances in fish from within 1 km and 30 km of the dam. Genetic variation was determined from electrophoretic comparisons at 21 structural gene loci. Mean heterozygosity was greatest at regulated sites. Tests for locus heterogeneity at five variable loci indicated that regulated and unregulated populations are not homogeneous. Fish under regulation were genetically more similar to each other than they were to those not affected by regulation. The proportions of the gene variance attributable to habitat alteration were partitioned, and fully one-third of the gene variation was attributed to stream regulation. Patterns of variation in thermal tolerance and metabolic enzymes in the red shiner correlated closely with temperature regimes associated with hypolimnion release from the dam. These adaptive responses have occurred in less than 40 years. (Author's abstract)
W86-00452

ACCUMULATION, ELIMINATION AND CHEMICAL SPECIATION OF MERCURY IN THE BIVALVES MYTILUS EDULIS AND MACROMA BALTHICA,
Odense Univ. (Denmark). Biological Inst.
H. U. Riisgard, T. Kiorboe, F Mohlenberg, I. Drabaek, and P. P. Madsen.
Marine Biology, Vol. 86, No. 1, p 55-62, April, 1985. 5 Fig, 3 Tab, 31 Ref.

Descriptors: *Mercury, *Bioaccumulation, *Mussels, *Clams, *Chemical speciation, Water pollution effects, Organomercury compounds, Mercury compounds, Heavy metals.

Mussels (Mytilus edulis) transferred in net bags from clean to chronically mercury polluted water readily accumulated mercury during an exposure period of three months. Growth of the transplanted mussels had a 'diluting' effect on the mercury concentration, but the absolute weight of mercury uptake increased throughout the entire period, though there was a tendency for decreased efficiency of the removal of mercury per liter of water filtered by the mussels. Mussels were also translocated from polluted to clean (laboratory) water to depurate mercury. The biological half-life of mercury was 293 d for M. edulis from the chronically polluted area in contrast to only 53 d for mussels from a temporary massive mercury polluted area near a chemical deposit. In both cases about 75% of the total mercury in the mussels was inorganic, and it is suggested that both inorganic and organic mercury species were immobilized in mussels from the long-term mercury polluted area, whereas the immobilization capacity was exceeded in the short-term mercury exposed mussels near the chemical deposit. Very slow elimination of mercury was observed in the deposit-feeding bivalve Macoma balthica from the chronically polluted area, and about 6% of the total mercury was methyl- + phenyl-mercury. This is more than three times lower than found in M. edulis from the same collecting site. A pronounced difference in the mercury speciation (i.e., total mercury, total organic mercury, methyl-mercury and phenyl-mercury) in M. edulis from the two mercury polluted areas is thought to reflect the different character of the mercury pollution in the two areas. (Author's abstract)
W86-00453

HEAVY METAL CONTENT OF OYSTER, BLUE MUSSEL AND GROWING WATER IN HANSAN-GEOJE BAY (IN KOREAN),
Fisheries Research an Development Agency, Pusan (Republic of Korea).
G.-C. Hwang, S.-J. Kim, and E.-H. Lee.
Bulletin of the National Fisheries University of Pusan, Vol. 24, No. 1, p 121-128, 1984. 1 Fig, 5 Tab, 21 Ref.

Descriptors: *Heavy metals, *Mussels, *Oysters, *Hasan-Geoje Bay, *Korea, Mercury, Cadmium, Copper, Lead, Zinc, Aquaculture, Shellfish, Water pollution effects.

Quantitative analyses of heavy metals (Hg, Cd, Cu, Pb and Zn) in oyster, Crassostrea gigas, and blue mussel, Mytilus edulis, and growing water associated with hanging cultures in Hansan-Geoje Bay on the south coast of Korea were conducted during the period of July to December 1982. The contents of heavy metals in shellfish by growth, water depth, and species were discussed. Copper content of surface seawater was generally higher than that of five meter deep water with average values of 5.0 and 3.3 ppb, respectively. There were few differences in mercury content between the two water depths with average values of 0.132 and 0.137, respectively. Cadmium, lead and zinc were not detectable. In oysters, copper and zinc content showed a gradually increasing trend with increasing meat weight, whereas there were small variations in cadmium, lead and mercury during the study period; there were no differences between surface and five meter depths. The levels of heavy metals in oyster were consistently higher than that in blue mussel. Heavy metal content of both oyster and blue mussel in Hansan-Geoje Bay in October showed higher metal concentration in shellfish during the study period: The values were 0.55 and 0.21 ppm for cadmium, 6.42 and 0.66 ppm for copper, 0.69 and 0.41 ppm for lead, 101.6 and 18.4 ppm for zinc and 0.009 and 0.006 ppm for mercury, respectively. They were much less than the alert levels for oyster proposed by the Chemical Task Force of U.S. FDA 7th National Shellfish Sanitation workshop in 1977 which were 1,000-2,000 ppm for zinc, 42-175 ppm for copper, 1.5-3.5 ppm for cadmium, 2.0 ppm for lead and 0.2 ppm for mercury. (Author's abstract)
W86-00454

EFFECTS OF METAL SPECIATION ON GROWTH OF PHYTOPLANKTON WITH SPECIAL REFERENCE TO IRON,

Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
H. de Haan.
Hydrobiological Bulletin, Vol. 18, No. 2, p 85-94, December, 1984. 6 Fig, 45 Ref.

Descriptors: *Phytoplankton, *Algal growth, *Metals, *Chemical speciation, *Iron, Lake Tjeukemeer, Netherlands, Ion exchange, Toxicity, Complexation, Chelation, Electrostatic attraction, Diatoms, Eutrophication.

A compilation of studies is reviewed concerning the effects of metal speciation on the growth of phytoplankton. In particular, attention is directed to the speciation and availability of iron in Lake Tjeukemeer, The Netherlands. Free ionic metal species generally appear to be most effective in determining metal availability and toxicity under laboratory conditions. Metal speciation is affected by a variety of factors controlling solubility, ion-exchange, complexation or chelation, sorption and electrostatic attraction of metal ions. Most of these factors result in reduced availabilities. In some cases, particular organic metal chelates such as citrates, nitrilotriacetates and the specifically iron chelating siderophores, are more available than the corresponding free ions. Other metals present also influence the availability of a given metal by competing for the same binding sites on the algal cell. In the eutrophic, alkaline, hard and humic lake Tjeukemeer, the free Fe(3+) concentration is below measurable levels and does not match the iron requirement of the phytoplankton, so most of the algal iron must have been provided by the predominant inorganic iron colloids and particles by dissolution or photodegradation. Different phytoplankton species vary widely in their metal requirements and tolerances. Therefore, metal speciation and availability may affect species composition and succession within phytoplankton communities. (Baker-IVI)
W86-00455

CONTENTS OF CD, FE, MN AND ZN IN THE TISSUE OF KATELYSIA HIANTINA COLLECTED FROM TOLO HARBOUR, AN ALMOST LAND-LOCKED SEA,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
M. H. Wong, and K. C. Au.
Hydrobiological Bulletin, Vol. 18, No. 2, p 95-101, December, 1984. 2 Fig, 3 Tab, 27 Ref.

Descriptors: *Clams, *Toxicity, *Heavy metals, *Tolo Harbor, *Hong Kong, Cadmium, Iron, Manganese, Zinc, Sediments, Mine tailings, Water pollution effects.

Samples of Katelysia hiantina (an edible clam) and sediments were collected from iron ore tailings and other nearby sites within Tolo Harbor (Hong Kong) for heavy metal analysis. The water quality of the harbor has deteriorated in recent years due to high inputs of nutrients, and reduced dilution and tidal flushing because of land reclamation and the enclosure of Plover Cove for use as a reservoir. The sediments, as well as the clams at the tailings, contained higher concentrations of Cd, Fe, Mn and Zn. Positive correlations between the metals in the sediments and clam tissues were found. The clams collected from the tailings showed a substantial loss of Fe, Mn and Zn when reared in clean filtered seawater for 8 days. (Baker-IVI)
W86-00456

SURVEY OF THE DISTRIBUTION OF CHIRONOMIDAE (DIPTERA, INSECTA) OF THE RIVER RHINE BY SAMPLING PUPAL EXUVIAE,
Bristol Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-00457

HYPERSCUMS OF THE CYANOBACTERIUM MICROCYSTIS AERUGINOSA IN A HYPERTROPHIC LAKE (HARTBEESPOORT DAM, SOUTH AFRICA),
National Inst. for Water Research, Pretoria (South Africa).
T. Zohary.
Journal of Plankton Research, Vol. 7, No. 3, p 399-409, 1985. 4 Fig, 2 Tab, 35 Ref.

Descriptors: *Microcystis, *Hyperscum, *Scum, *Hartbeespoort Dam, *South Africa, Cyanophyta, Eutrophication, Chlorophyll a, Photosynthesis, Anoxic conditions, Hydrogen ion concentration.

It is proposed that surface scums of densely packed planktonic cyanobacteria (blue-green algae) which exist for weeks to months, measure several decimeters in thickness and are covered by a crust of photo-oxidized cells, be called hyperscums. Hyperscums of Microcystis aeruginosa formed during prolonged periods of calm weather in wind-protected sites in a hypertrophic lake subject to low wind speeds (Hartbeespoort Dam, South Africa). A hyperscum that extended over 1-2 hectares and persisted for 103 days during winter 1983 was studied. Chlorophyll a concentrations ranged from 100 to 300 mg/l. Microcystis cell concentrations reached 1.76 x 10 to the 9th power cells/ml or 116 cu cm/l. The hyperscum environment was anoxic, aphotic, with a fluctuating temperature regime and low pH values. The densely packed Microcystis cells survived these conditions for more than 2 months. This was shown by comparing the potential photosynthetic capacity of Microcystis from the hyperscum with that of Microcystis from the main basin of the lake. However, after 3 months the hyperscum algae lost their photosynthetic capacity and decomposition processes prevailed. The hyperscum gradually shrank in size until a storm caused its complete disintegration. (Author's abstract)
W86-00519

MEIOFAUNA ASSOCIATED WITH MANGROVES IN THE HUNTER RIVER ESTUARY AND FULLERTON COVE, SOUTH-EASTERN AUSTRALIA,
Australian National Univ., Canberra. Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W86-00521

CHANGES OF FLORA AND VEGETATION OF THE CALCAREOUS STREAMS IN THE 'FRIEDBERGER AU' (NEAR AUGSBURG) BETWEEN 1972 AND 1982 UNDER CHANGING POLLUTION CONDITIONS (VERANDERUNGEN VON FLORA UND VEGETATION IN DEN KALKREICHEN FLIESSGEWASSERN DER FRIEDBERGER AU (BEI AUGSBURG) VON 1972 BIS 1982 UNTER VERANDERTEN BELASTUNGSBEDINGUNGEN),
Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Landeskultur und Pflanzenokologie.
A. Kohler, and S. Schiele.
Archiv fur Hydrobiologie, Vol. 103, No. 2, p 137-199, 1985. 9 Fig, 5 Tab, 12 Ref.

Descriptors: *Aquatic plants, *Water pollution effects, *Friedburger Au, *Germany (Federal Republic), Calcareous streams, Wastewater pollution, Vegetation, Macrophytes,.

The Friedberger Au lies in the Lech-Wertach-Ebenen Nature Area in the immediate neighborhood of Augsburg. The flora and vegetation of a calcareous stream in the Friedberger Au was mapped in 1972, 1978 and 1982. Wastewater pollution in the Friedberger Au changed between 1972 and 1982. The most important change was the diversion of wastewater from the city of Friedberg in 1974 to treatment facilities in Lech and Paar. Other communities in the area introduced improved treatment during this period. The alteration of flora and vegetation under changing pollution conditions was studied. Macrophytic recolonization of a formerly overloaded zone took at least 8 years. Some species have not recolonized this part of the stream. Nearby ditches which were initially oligotrophic showed both qualitative and quantitative increases in eutrophic species and decreases in oligotrophic species due to increasing pollution load. (Moore-IVI)
W86-00524

PROBLEM OF SARDINE FISHER EGYPT,
Institute of Oceanography and Fisheries, dria (Egypt).
N. F. Bishara.
Archiv fur Hydrobiologie, Vol. 103, No. 265, 1985. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Water pollution effects, * fects, *Sardines, *Commercial fisheries, Nile River, Aswan High Dam, Environm fects, Wastewater pollution, Plankton.

In Egypt, sardines are caught along the M nean coast from Alexandria to El-Ar points of concentration at Alexandria, Ro mietta, Abu Kir bay and Port Said. Fron 1978, there was a marked decrease in sarc ings along the Mediterranean coast of Eg tors responsible for this decline include struction of the high dam at Aswan in 1 increased water pollution by sewage and wastes. The Aswan High Dam greatly rec flow of the Nile, and also reduce planktor tion in the Mediterranean waters. In th from 1978 through 1981, sardine fisherie to be thriving once more. (Moore-IVI)
W86-00525

EFFECT OF ADHERENT BACTERI BACTERIAL EXTRACELLULAR POI UPON ASSIMILATION BY MACOMA ICA OF SEDIMENT-BOUND CD, ZN
Geological Survey, Menlo Park, CA. W sources Div.
R. W. Harvey, and S. N. Luoma.
Marine Ecology - Progress Series, Vol. 2 p 281-289, March, 1985. 2 Fig, 4 Tab,

Descriptors: *Bacteria, *Exopolymers, *Cadmium, *Zinc, *Silver, Sediments, P matter, Bioavailability, Heavy metals, environment, Behavior.

Effects of adherent bacteria and bacterial lular polymer (exopolymer) upon uptake cle-bound Cd, Zn and Ag by the depos clam Macoma balthica were studied in th tory. Amorphous iron oxyhydroxide and and alkaline-extracted sediments were model particulates in separate, controlle feeding experiments. In general, amounts taken up from ingested particles varied dr ly with the nature of the particle surface. of contaminated iron oxide particles did tribute to overall uptake of Cd and Ag i clams, but accounted for 89 to 99% of uptake. Exopolymer adsorbed on iron ox cles caused an increase in the biological a of particle-bound metals in the order Ag Zn, whereas adherent bacteria up to 3.2 x 11th/g had no effect upon amounts of m up from ingested particulates. At the h and Ag concentrations employed (3.6 x 1 M), feeding rates declined with increasing of iron oxide-bound exopolymer, sugge havioral avoidance due to increased me ability. Much of the Cd (57%) taken up feeding on unaltered estuarine sediments from particulates, even though particle/s tribution of Cd (86%) was similar to that ments with iron oxide particles. Uptake o alkaline-extracted sediments was insignifi was from unamended iron oxide. Howe tion of exopolymer (10 mg/g sediment) restoration in bioavailability of sedim Cd. (Author's abstract)
W86-00528

COMPARISON OF THE TOXIC EFFI TWO PESTICIDES ON THE TESTE FRESH WATER TELEOST CHANNA TUS BL.,
Government Coll., Mhow (India). Dept. gy.
N. Arora, and S. K. Kulshrestha.
Acta Hydrochimica et Hydrobiologica, No. 4, p 435-441, 1984. 3 Fig, 4 Tal

escriptors: *Pesticide toxicity, *Channa, *Carryl, *Endosulfan, Toxicity, Fish, Carbamate pesides, Chlorinated hydrocarbon pesticides, stes.

comparative study was made of the toxic effects sublethal doses of two extensively used pesties, a carbamate compound carbaryl and an orochlorinated compound endosulfan on the es of a fresh water teleost, Channa striatus. le specimens were exposed to 10 and 20 ppm baryl and 0.00075 and 0.001 ppm of endosulfan a period of 30 d. At both dose levels, carbaryl endosulfan produced the following effects: ture of the peritoneal lining; rupture of the wall seminiferous lobules; failure of spermatogenesis he spermatid stage; necrosis of interstitial cells; fibrosis of the connective tissue. There was a gressive reduction in different stages of the rmatogenetic activity with an increase in the ation of the exposure. After 30 d of exposure y spermatogonia were seen. (Moore-IVI)
6-00544

VIRONMENTAL BEHAVIOR OF FLUORONSIDES; PART 1: WATER TOXICITY TEST- (ZUM UMWELTVERHALTEN VON UORTENSIDEN; TEIL 1: PRUFUNG AUF UATOXIZITAT),

ademie der Wissenschaften der DDR, Berlin. tralinstitut fuer Organische Chemie.
Prescher, U. Gross, J. Wotzka, M. Tscheluter, and W. Starke.
a Hydrochimica et Hydrobiologica, Vol. 12, 6, p 595-600, 1984. 2 Fig, 2 Tab, 9 Ref.

criptors: *Surfactants, *Fluorotensides, *Tox-, Guppies, Algae, Water pollution effects, er quality standards.

cilia reticulata Peters (guppy) and the green Monoraphidium griffithii were used for testof different fluorotensides. After the represenn of the methods of investigation and the nition of criteria of toxicity the results obtained he investigation are discussed. In general, the city of the four investigated fluorotensides to e was lower than to fish. The anionic fluorode CF3-(CF2)n-CFH-COONa was an exceptThe results are summarized in tables and rams. Finally, for the condition of the receivwater biocenosis class '2' the respective still nissible matter concentrations are proposed. y vary between 0.05 and 0.2 mg/l. (Author's act)
-00546

RIN INDUCED CHANGES IN THE ACTIES OF THREE PHOSPHATASES OF CROBRACHIUM LAMARREI (H. MILNE VARDS),

khpur Univ. (India). Dept. of Zoology.
. Murti, and G. S. Shukla.
Hydrochimica et Hydrobiologica, Vol. 12, 6, p 609-613, 1984. 1 Tab, 24 Ref.

riptors: *Aldrin, *Enzymes, *Macrobrachium, Toxicity, Pesticide toxicity, Metabolism, s.

obrachium lamarrei was exposed to 0.008, and 0.021 mg/l aldrin (0.4, 0.8 and 1.0 of the ,96h) for 24-96h and after exposure the activiof the acid, alkaline and glucose-6-phosphaare determined. With concentration and time xposure the acid phosphatases shows an ining activity up to 170% compared with the ol, which is interpreted as part of prenecrotic ges in the cells. With concentration and time posure the alkaline phosphatase shows a deing activity down to 20% of the control, h is indicative of considerable disturbances of otal metabolism. The glucose-6-phosphatase s an increasing activity with the aldrin conation up to 150% during 72 h; then the activiops to 60-80%. The initial rise in the glucose ntration of blood caused by that is the clear quence of a stress reaction and the change of olism resulting from it. (Author's abstract)
00547

STUDIES ON THE TOXICITY OF SOME INSECTICIDES TO A FRESHWATER TELEOST LEBISTES RETICULATUS (PETERS),

K.L.D.A.V. Coll., Roorkee (India). Dept. of Zoology.
P. K. Gupta, V. S. Mujumdar, and P. S. Rao.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 629-636, 1984. 4 Tab, 37 Ref.

Descriptors: *Insecticides, *Toxicity, *Lebistes, Fish, Pesticide toxicity, Endosulfan, Lindane, Aldrin, Chlordane, Rogor, Novocrom.

The toxicity of endosulfan, lindane, aldrin, chlordane, rogor and novocrom to the freshwater fish Lebistes reticulatus was investigated for exposure periods of 12-96 h in batch tests with daily exchange of the medium. The mean survival periods and the LC50 were determined. During the early hours of exposure to the insecticides, the opercular movements of the fish decreased. Later the opercular movements increased, and the fish swam erratically, lost balance, and died. Toxicity increases in the following sequence (LC50,96h) (in mg/l): novocron (22.65), rogor (18.97), chlordane (0.341), aldrin (0.017), lindane (0.0160), endosulfan (0.0027). The following safe concentrations in mg/l are recommended: 0.0006 endosulfan, 0.0041 lindane, 0.0010 aldrin, 0.1436 chlordane, 5.4086 rogor and 7.2309 novocron. Presumable safe concentrations of the insecticides to the fish are a fraction of their respective LC50 values and may help to a great extent in determining water quality criteria. (Moore-IVI)
W86-00548

ACUTE TOXICITY OF MERCURIC CHLORIDE AND CADMIUM CHLORIDE TO FRESHWATER PRAWN, MACROBRACHIUM LAMMARREI (H. MILNE EDWARDS),

Gorakhpur Univ. (India). Dept. of Zoology.
R. Murti, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 689-692, 1984. 1 Tab, 16 Ref.

Descriptors: *Prawn, *Toxicity, *Mercuric chloride, *Cadmium chloride, Mercury compounds, Cadmium compounds, Behavior, Mortality, Crustaceans.

Toxicity of HgCl2 and CdCl2 in Macrobrachium lamarrei (H. Milne Edwards) was demonstrated in aquarium tests conducted with field-collected Indian specimens over test periods of 24-96 hr. The LC sub 50 for HgCl2 ranged from 0.167 mg/l (24 hr) to 0.095 (96 hr); the respective figures for CdCl2 were 0.374 mg/l and 0.195 mg/l, indicating that CdCl2 is somewhat less toxic. Tests were conducted at pH 7.4 +/- 0.2 and 26 C +/- 1.5 C. Organisms became excited and exhibited spontaneous swimming just after transfer to test solutions of both chemicals, and lost their balance and settled to the bottom very soon in mercuric chloride and after about an hour in cadmium chloride solution. A thin film of mucus was observed in the gill region of CdCl2-exposed prawns, but was not well-marked in those exposed to HgCl2. No mortality was observed up to 96 hr in 0.050 mg/l HgCl2; the comparable figure for CdCl2 was 0.12 mg/l. M lamarrei appears to be the most sensitive of all crustaceans to these two metals, but it is difficult to make comparisons with other species because of differences in temperature optima. (Rochester-IVI)
W86-00553

RELATIVE TOXICITY OF PHENOXY HERBICIDES ON LEBISTES (POECILIA) RETICULATUS (PETERS),

Udaipur Univ. (India). Dept. of Limnology and Fisheries.
H. K. Vardia, and V. S. Durve.
Proceedings of the Indian Academy of Sciences (Animal Sciences), Vol. 93, No. 7, p 691-695, December, 1984. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Herbicides, *Toxicity, *Lebistes, *Phenoxy herbicides, Aquatic weed control, Pesticide toxicity, 2,4-D, Regression analysis, Dichlorophenoxyacetic acid.

Phenoxy herbicides (2,4-D, its sodium and ethyl amine salts and ethyl esters) commonly used in aquatic weed eradication programs, were tested by acute and static bioassay investigations on a cyprinid fish Lebistes (Poecilia) reticulatus under laboratory conditions. The toxicities of these different formulations are compared and reported in relative toxicity ratings. 'Safe application rate' and 'safe application factor' equations were also calculated. Median lethal concentrations at various time intervals are also reported along with respective fiducial limits and regression equations. Comparative regressions are drawn for three time intervals, 24, 48 and 96 hr. (Author's abstract)
W86-00577

PATTERNS OF BIOACCUMULATION OF AN ESSENTIAL TRACE ELEMENT (ZINC) AND A POLLUTANT METAL (CADMIUM) IN LARVAE OF THE PRAWN PALAEMON SERRATUS,

Institut Francais de Recherche pour l'Exploitation de la Mer, Nantes (France). Lab. Effets Biologiques des Nuisances.
J. Devineau, and C. A. Triquet.
Marine Biology, Vol. 86, No. 2, p 139-143, May, 1985. 4 Fig, 1 Tab, 28 Ref.

Descriptors: *Bioaccumulation, *Zinc, *Cadmium, *Prawn, Larval growth stage, Water pollution effects, Heavy metals, Crustaceans.

Palaemon serratus Pennant larvae from females caught near Roscoff (France) of the Bay of Biscay in 1983, were reared in the laboratory. From hatching to the first stage after metamorphosis, the larvae were exposed to zinc and cadmium introduced separately or together into the rearing medium. At the end of experimental contamination, the concentrations of the two metals in the organisms were determined. The level of zinc in organisms was mainly independent of its concentration in the water, suggesting that the bioaccumulation of this essential trace element is controlled by some physiological process. The accumulation of cadmium in the larvae paralleled the overloads of this metal in the water. Increased zinc concentrations in water have little or no effect on the cadmium levels in organisms. The most important interaction between these two metals is an antagonism exerted by cadmium on the biological uptake of zinc. (Author's abstract)
W86-00580

RELATIONS BETWEEN BIOACCUMULATION AND WEIGHT OF ORGANISMS,

Swedish Water and Air Pollution Research Lab., Stockholm.
P.-E. E. Bergner.
Ecological Modelling, Vol. 27, No. 3/4, p 207-220, April, 1985. 6 Fig, 17 Ref.

Descriptors: *Bioaccumulation, *Fate of pollutants, *Aquatic organisms, Accumulation, Metabolism.

Empirical bioaccumulation data indicate the existence of systematic relations between the extensive quantity size of organism and the intensive quantity weight concentration of accumulating substances. The characteristic co-variation between body weight and weight concentration observed in organisms is rationalized on the basis of simple and biologically reasonable postulates. In particular it turns out that the frequently assumed connection between weight concentration and age is not a prerequisite in order to explain the observed phenomenon. The basic principles to be applied are that a change in an organism's size does not directly alter the metabolism of the individual cells, and that usually the total uptake of most substances by an organism increases with the organism's size. The conclusion is drawn that, when working on problems that involve bioaccumulation processes, the absolute size of organisms should be included in the analysis, no matter what specific model is applied. (Baker-IVI)
W86-00594

PHYSIOLOGICAL RESPONSES TO POLLUTION,
Institute for Marine Environmental Research, Plymouth (England).
J. Widdows.
Marine Pollution Bulletin, Vol. 16, No. 4, p 129-134, April, 1985. 2 Fig, 31 Ref.

Descriptors: *Water pollution effects, *Physiological ecology, Physiological responses, Aquatic animals, Monitoring, Toxicology.

The measurement of changes in the physiological responses of individual organisms should form an important component of any toxicological or environmental monitoring program. The rate of growth is a fundamental component of physiological fitness and therefore represents an important index of environmental (pollutant) effect. An additional index can be calculated from the physiological components of the energy equation in order to provide further information on the efficiency with which an animal functions. Shell growth measurement, where appropriate, can serve to integrate and record changes in environmental quality over a period of weeks or months. Reproductive processes form a critical interface between the individual and the population. Behavioral responses, including bivalve shell gape and rate of byssal attachment have been suggested as simple methods of monitoring changes in environmental quality, but they are generally difficult to quantify and interpret. In order to calculate the assimilative capacity (or rate) of receiving waters by means of environmental quality models it is necessary to identify toxic contaminants, identify and characterize the sources and sinks of contaminants, identify the key resource to be protected, and establish dose-response relationships for relevant contaminants and appropriate target organisms. Physiological measurements of pollution impact therefore have an important role in environmental pollution monitoring. (Baker-IVI)
W86-00597

ASSESSMENT OF THE BIOLOGICAL EFFECTS OF SEWAGE SLUDGE AT A LICENSED SITE OFF PLYMOUTH,
Water Research Centre, Marlow (England).
T. J. Lack, and D. Johnson.
Marine Pollution Bulletin, Vol. 16, No. 4, p 147-152, April, 1985. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Water pollution effects, *Sludge disposal, *Plymouth, *England, Marine pollution, Toxicity, Mussels, Metals, Enzymes.

Mussels were placed in cages at sites were chosen to lie along a hypothetical pollution gradient. Two cages were held 4 m below the surface and two 4 m above the sea bed. The depths of water ranged from about 10 m at Site 1 to about 60 m at Site 7. There is an indication that animals in the upper cages were more stressed by the sewage disposal than animals in the lower cages. The lowest scope for growth (SFG) was found in the upper animals at site 5 on the edge of the sludge disposal ground, with significant improvements in SFG moving inshore to site 1 and offshore to site 7. Of the upper animals, those at sites 2, 3, 5, and 6 had significantly lower SFG than at site 1. There was no significant difference between the lower animals except those at site 2, where the lowest SFG was recorded. Concerning lysosomal stability, all the animals from the upper cages showed significantly more stress than the control animals. For the animals contained within the upper cages the most stressful site was at the center of the disposal ground, with progressively less stress being detected at the sites away from the ground. The inshore site was the least stressful for both upper and lower animals although only two sections of the lower animals were assayed. The upper caged animals had elevated levels of organic detoxication enzymes and there was evidence of two possible sources of stress; land based or estuarine inputs affecting animals near the shore at sites 1 and 2 and sewage sludge affecting animals around the disposal ground at sites 5, 6, and 7. The lower cages anmials showed evidence that a metal detoxication system had been induced. It appeared that two sources may be involved; land-based, estuarine and metal-enriched sediments affecting the near shore and shallower sites and sewage sludge affecting those animals closest to the disposal ground. (Baker-IVI)
W86-00599

FISH GILL STRUCTURAL CHANGES INDUCED BY TOXICANTS AND OTHER IRRITANTS: A STATISTICAL REVIEW,
Washington State Univ., Pullman. Dept. of Zoology.
J. Mallatt.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 630-648, April, 1985. 1 Fig, 7 Tab, 130 Ref.

Descriptors: *Water pollution effects, *Fish, *Gills, *Reviews, Toxicity, Histology, Pathology, Irritants, Statistical studies, Morphology, Osmolality, Ultrastructure.

The literature on how fish gill morphology is affected by chemical and physical irritants in the surrounding water (e.g. various toxicants, extremes of temperature or pH) is quantitively reviewed. Histopathological gill lesions that were reported are catalogued, and statistics are to explore how such lesions relate to the irritant-exposure conditions under which they occurred (specifically, to dose and class or irritant, to temperature, and to salinity of the surrounding water). Frequently recorded histopathologic lesions include changes in gill epithelium (lifting, necrosis, hyperplasia, rupture), bulbing or fusing of gill lamellae, hypersecretion and proliferation of mucocytes, and changes in chloride cells and gill vasculature. It is concluded that these lesions are largely nonspecific in nature, as each was detected under many different exposure conditions. The lesions are not entirely independent of exposure conditions, however, as the statistical analysis discerns these trends: (1) Most gill lesions types have been reported more frequently after lethal than after sublethal exposure of irritants. (2) Some lesions were more frequently detected in studies employing heavy metals than in studies using organic toxicant or other irritants; such lesions include necrosis and hypertrophy of gill epithelial cells, plus mucous hypersecretion. (3) Lifting of the branchial epithelium, the most commonly reported lesion, was reported more often in freshwater than in marine fish, suggesting the osmolarity of the ambient water influences this lesion. Little relation was found between recorded lesion frequencies and temperature. Following the statistical analysis, the etiology of irritant-induced gill lesions is considered. The nonspecificity, of branchial alteration suggests that they primarily represent sterotyped physiological reactions of gills to stress, and many of them are logically considered defense responses. Some branchial alterations have been considered inflammatory, but it is concluded that the literature cannot support that hypothesis. Ultrastructural studies have detected irritant-induced disruptions of branchial epithelial cells, including cytoplasmic vacuolization, autophagosomes and inclusions, loss of microvilli, and abnormal mitochondria and nuclei. (Author's abstract)
W86-00602

WHOLE-LAKE FERTILIZATION EXPERIMENTS IN COASTAL BRITISH COLUMBIA LAKES: EMPIRICAL RELATIONSHIPS BETWEEN NUTRIENT INPUTS AND PHYTOPLANKTON BIOMASS AND PRODUCTION,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
J. G. Stockner, and K. S. Shortreed.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 649-658, April, 1985. 7 Fig, 2 Tab, 37 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Biomass, *Lakes, *British Columbia, *Fertilization, Monomictic, Nitrogen, Phosphorus, Trophic level, Nutrients, Chlorophyll.

Seventeen warm monomictic coastal lakes in British Columbia were studied from 1980 to 1983. Inorganic nitrogen and phosphorus were applied to 13 of the lakes in some or all years of the study. In the untreated condition, lakes were ultraoligotrophic with low concentrations of nutrie 4.1 micro-g total P/L at spring overturn), a age summer chlorophyll (0.49-2.57 mic and of average daily primary production mg C/cu m/d). The lakes' oligotrophic c is sustained by their low residence time (0. and by low nutrient inputs from the genera granitic drainage basins. The lakes respond ably to nitrogen and phosphorus additions generally phosphorus limited, as shown significant positive relationships between summer chlorophyll and total phosphorus overturn (r sq = 0.81) in unfertilized l tween average summer chlorophyll and rus load from fertilizer (r sq = 0.62) in lakes, by the high average particulate C:N (152:20:1), and by the high average TN: (89). (Author's abstract)
W86-00603

ACIDIFICATION EFFECTS ON S BIOTA AND ORGANIC MATTER P ING,
Michigan State Univ., East Lansing. Dep ology.
T. M. Burton, R. M. Stanford, and J. W. A
Canadian Journal of Fisheries and Aqu ences, Vol. 42, No. 4, p 669-675, April, 19 5 Tab, 19 Ref.

Descriptors: *Stream biota, *Organic *Acidification, Water pollution effects, D sition, Leaves, Detritus, Invertebrate streams, Aquatic insects, Isopods, Snails, ty.

Experimental acidification effects on stre and organic matter decomposition rates i low alkalinity (7-15 mg CaCO3/L) streams were studied using paired, artific culating streams. Acidification to pH 4 w ric acid from pH 7.0 to 7.4 resulted in s decreased decomposition rates for 5-g leaf white birch (Betula papyrifera) and sug (Acer saccharum). Populations of total vertebrates on leaf packs in the acid str stantially reduced over a 264-d exposur whereas populations remained unchang control stream. Detailed studies were c on a caddisfly, Lepidostoma liba, and a Asellus intermedius. The Lepidostoma p was resistant to short-term exposure to tion, but significant mortality occurred a at pH 4 at 2-4 C. Late instars were not af acidification and emerged after more tha 15-20 C. Asellus was very sensitive to aci with up to 93% mortality after only 24 d inhibition of reproduction. Acidificatior ported in increased mortality for a sna heterostropha, and another caddisfly, Pyc sp. (Author's abstract)
W86-00604

DEPTH DISTRIBUTION AND BIOM SUBMERSED AQUATIC MACR COMMUNITIES IN RELATION TO DEPTH,
McGill Univ., Montreal (Quebec). Dept ogy.
For primary bibliographic entry see Field
W86-00606

INFLUENCE OF PH, WATER HA AND ALKALINITY IN THE ACUTE LITY OF ZINC TO RAINBOW (SALMO GAIRDNERI),
Guelph Univ. (Ontario). Dept. of Zoolog
R. W. Bradley, and J. B. Sprague.
Canadian Journal of Fisheries and Aq ences, Vol. 42, No. 4, p 731-736, April, 1 2 Tab, 38 Ref.

Descriptors: *Toxicity, *Zinc, *Trout, * ion concentration, *Alkalinity, *Hardne pollution effects, Mortality, Carbonates, precipitation, Dissolved solids.

The acute lethality of dissolved zinc t trout (Salmo gairdneri) was significantly

higher pH and lower hardness levels. Changes in from 5.5 to 7.0 increased zinc toxicity by tors to 2 to 5, depending on total hardness els. A decrease in hardness from 386 to 31 mg CO3/L increased zinc toxicity by more than an ler of magnitude at both pH levels. These effects pH and hardness were not caused by changes in chemical speciation of zinc. An increase in bonate alkalinity from 8.4 to 24 mg CaCO3/L pH 7.0 did not significantly alter zinc toxicity at ier hardness level. Thus, carbonate alkalinity is an important factor at or below pH 7.0. At low dness, dissolved zinc was more than 10 times as ic at pH 9.0 as at pH 5.5. Two competing chanisms appear to operate: as the pH rises, olved zinc becomes increasingly toxic, but at her pH levels it is increasingly replaced by zinc cipitate, which is of very low toxicity to fish. thor's abstract)
6-00608

STSETTLEMENT DIATOM SUCCESSION THE BAY OF QUINTE, LAKE ONTARIO,
higan Univ., Ann Arbor. Great Lakes Re- ch Div.
F. Stoermer, J. A. Wolin, C. L. Schelske, and . Conley.
adian Journal of Fisheries and Aquatic Sci- es, Vol. 42, No. 4, p 754-767, April, 1985. 9 Fig, ab, 30 Ref. EPA grant R810396, NSF grant E-8216588.

criptors: *Diatoms, *Succession, *Bay of nte, *Lake Ontario, *Ontario, History, Eu- hication, Silica, Fossils, Chrysophyta, Mining, er pollution effects.

eous algal microfossil assemblages deposited in Bay of Quinte prior to European settlement ist of low numbers of benthic diatoms and sophyte cysts. Early settlement activities are ked by qualitative changes in the flora and l increases in microfossil flux. Events associat- vith the Ambrosia horizon produced a rapid sition from assemblages characteristic of oligo- hic environments to those characteristic of eu- hic waters and a large increase in microfossil This was followed by a period of decreasing eous microfossil flux and reestablishment of eutrophic species ca. 1853-61. Minimum sili- s algal microfossil flux and highly atypical nblages occurred in the period ca. 1879-88, h corresponds to the period of intensive ng activities in the Bay of Quinte watershed. mum flux of siliceous microfossil occurred ca. and declined thereafter, although composition ssemblages deposited indicates increasing eu- y and displacement of summer-blooming spe- This is interpreted as evidence of beginning of ner silica limitation. Based on microfossil evi- e, the modern eutrophic flora of the bay was lished by 1928. (Author's abstract)
-00609

ECTS OF LOW ENVIRONMENTAL PH ON SURVIVAL, GROWTH AND IONIC COM- ITION OF POSTEMERGENT ATLANTIC MON (SALMO SALAR),
rtment of Fisheries and Oceans, St. Andrews r Brunswick). Fisheries Research Branch.
Lacroix, D. J. Gordon, and D. J. Johnston.
dian Journal of Fisheries and Aquatic Sci- , Vol. 42, No. 4, p 768-775, April, 1985. 3 Fig, , 30 Ref.

riptors: *Salmon, *Hydrogen ion concentra- *Water pollution effects, Immature growth s, Bioassay, Mortality, Growth, Calcium, m, Westfield River, Nova Scotia.

mergent Atlantic salmon (Salmo salar) were d during the early feeding phase in the soft, water of the Westfield River (mean pH 5.0) ova Scotia. The fry were held in a flow- gh system of tanks in situ and were fed a ery diet. Bioassays were also conducted in water treated with limestone (mean pH 6.1) ovide a control. Cumulative mortality of fry 30 d in the tanks was 70% at pH 5.0 and only t pH 6.1. Fry in untreated river water were ve, ingested little food, and lost weight (approximately 25%) during the first 15 d of exposure. Large increases in body (Ca(2+)) and (Na(+)) were observed in fry at both pH levels during that time, but the increase in (Ca(2+)) lagged and that in (Na(+)) was less in fry at low pH. Deaths occurred 15-30 d after swim-up and dead fry were all severely emaciated, indicating the deaths were probably from starvation. Although there were differences in ionic composition changes in fry held at pH 5.0 compared with control, no major depletion of body ionic reserves occurred relative to initial concentrations. Surviving fry a pH 5.0 developed a tolerance after 25 d and had growth rates, condition factors, and ionic concentrations similar to those to fry in treated water. The mortality of fry during the transition to exogenous feeding, in response to low pH stress in soft water, is probably responsible for reduced recruitment and the decline or loss of salmon stocks in this and other acidic rivers of Nova Scotia. (Author's abstract)
W86-00610

5D. Waste Treatment Processes

INNOVATIVE/ALTERNATIVE WASTEWATER COLLECTION SYSTEMS FOR CORPS OF ENGINEERS RECREATION AREAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
M. J. Cullinane.
Miscellaneous Paper EL-81-7, September 1981. 36 p, 10 Ref.

Descriptors: *Wastewater treatment, *Wastewater collection, *Sewer systems, *Septic tanks, *Recreation facilities, Wastewater disposal, Pressure sewer systems, Vacuum sewer systems, Gravity flow.

Design considerations are given for several wastewater collection and transmission alternatives for recreation areas. Choice of a system is site-specific. The conventional gravity collection system is easy to maintain, expand, and operate; however, capital costs are high, especially if terrain or excavation problems exist. Pressure systems are of two types: (1) GP, which has a holding tank, grinder pump, electrical and mechanical components, and collection system piping and (2) STEP, which has a septic tank, one-site pressurization unit, and collection system piping. Vacuum systems have a central vacuum source to maintain a constant vacuum on the main line of the collection systems. Small-diameter gravity systems, not widely used in the U.S., include on-site septic tanks that drain into small-diameter gravity sewers. Cost information is provided for each system.
W86-00331

MEMBRANE CONTROLLED PROCESSES FOR THE ENERGY-EFFICIENT CONVERSION OF SLUDGES TO FUELS AND MARKETABLE CHEMICALS.
Columbia Univ., New York.
Available from the National Technical Informatin Service, Springfield, VA 22161 as DE82013685. Department of Energy, Washington, DC. Office of Renewable Technology. Report DOE/CS/20400-1. March 1982. 254 p. 69 Fig, 26 Tab, 106 Ref. Contract/Grant No. DE-AC01-78CS20400.

Descriptors: *Wastewater treatment, *Byproducts, *Membrane processes, Anaerobic digestion, Aerobic treatment, Sludge digestion, Municipal wastes, Solid wastes.

The development of a process for the membrane-controlled conversion of urban solid wastes and sludges into fuels and marketable chemicals is reported. It is highly cost-effective and energy efficient because of the substantial value of the chemical by-products obtained. Sludges are concentrated to permit smaller fermenters and are then fermented rapidly and efficiently under membrane control. All the undesirable by-products are converted into useful chemicals such as liquid ammonia and organic acids. This is followed by a secondary aerobic fermentation to obtain the virtually complete destruction or conversion of all organic matter to chemical by-products. This system is highly compact and capable of being placed into operation at sewage treatment plants to effect a virtually closed-loop operation.
W86-00361

MARKET ASSESSMENT AND TECHNOLOGICAL EVALUATION OF THE CPU-4000 CHEMICAL PRECIPITATION UNIT,
Battelle Columbus Labs., OH.
J. L. Means, N. D. Gregorich, and E. W. Helper.
Final Report, October 25, 1983. 33 p, 1 Fig, 8 Tab, 26 Ref, Append.

Descriptors: *Heavy metals, *Metal-finishing wastes, *Separation techniques, *Chemical precipitation, *Wastewater treatment, Marketing, Effluent limitations, *Industrial wastewater, Industrial wastes, Metals, Comparison studies.

A market assessment of the CPU-4000, a device which can be used as a pollution control mechanism for heavy metals in industrial effluents is given along with a comparison of CPU-4000 technology with that of other metal removal techniques. A target market for the CPU-4000 ranging from 23,828 to 23,891 firms was identified. In the metal finishing industry, 5,060 markets are identified; and in the photofinishing industry, 5,500 markets are attributed to hospitals and 9,801 markets are attributed to graphic art firms. Photographic processing accounts for 1,667-1,730 markets for CPU-4000 technology while non-destructive testing, used in such industries as aerospace, oil pipelines, and nuclear science accounts for 1,800 markets. EPA discharge regulations for the electroplating and metal finishing industries limit cyanide, Pb, Cd, Cu, Ni, Cr, Zn and Ag for plants with a daily flow of 38,000 liters and Pb, Cd, and cyanide for plants with a daily flow of < 38,000 liters. The sodium sulfide precipitation technique is considered extremely effective for treating wastewater containing toxic metal ions. The CPU-4000 which embodies the sodium sulfide precipitation technique can remove up to 30 different metal ions whereas electrolytic deposition, metallic replacement and ion exchange are generally effective in removing only a single metal ion.
W86-00386

DIGESTION OF FORMALDEHYDE BY ADAPTED BACTERIA (ZUM ABBAU VON FORMALDEHYD DURCH ADAPTIERTE BAKTERIEN),
Karl-Marx-Univ., Leipzig (German D.R.). Sektion Biowissenschaften.
U. Behrens, and J. Hannes.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 39-45, 1984. 3 Fig, 18 Ref.

Descriptors: *Formaldehyde, *Biological wastewater treatment, *Bacteria, Wastewater treatment, Activated sludge process.

Municipal activated sludge was cultivated in a medium composed of formaldehyde, glucose and mineral salts. By passages with increasing formaldehyde concentrations, a bacterial culture was selected which remained active at initial concentrations of 1 g/l formaldehyde. With this culture, formaldehyde and glucose were oxidized simultaneously to formate and gluconate, which subsequently served as substrate for the growth of bacteria. Glucose alone was also oxidized to gluconate, which then was used as substrate for growth. Formaldehyde alone was only oxidized. If the actual formaldehyde concentration was kept low, however, by fed-batch cultivation, it was assimilated through formate formation. The biochemical background and the importance of the findings for the purification of formaldehyde-containing wastewaters are discussed. (Author's abstract)
W86-00397

OCCURRENCE OF R-PLASMIDS IN ESCHERICHIA COLI AND COLIFORM GERMS FROM WATER AND WASTEWATER; PART 2: METHODS OF ISOLATION OF R+ -BACTERIA FROM SURFACE AND WASTEWATER, THE

TRANSFER OF THEIR R-PLASMIDS AS WELL AS THE DETERMINATION OF THE RESISTANCE IMAGES (UBER DAS VORKOMMEN VON R-PLASMIDEN IN ESCHERICHIA COLI UND KOLIFORMEN KEIMEN AUS WASSER UND ABWASSER; TEIL 2: METHODEN DER ISOLIERUNG VON R+ - BACTERIEN AUS OBERFLACHEN - UND ABWASSER, DES TRANSFERS IHRER R-PLASMIDE SOWIE DIE BESTIMMUNG DER RESISTENZ-BILDER),
Institut fur Experimentelle Epidemiologie, Wernigerode.
H. Heier, and H. Tschape.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 47-54, 1984. 4 Tab, 14 Ref.

Descriptors: *Escherichia, *Coliforms, *Plasmids, *Wastewater, *Surface waters, Bacteria, Hospitals, Antibiotic resistance, Municipal wastewater, Effluents, Wastewater treatment facilities.

A detailed description is given of methods for the isolation of R+ bacteria from water and wastewater, the determination of their resistance pattern and the transfer of R-plasmids from wild strains to Escherichia coli K 12. Results are given of investigations on the inflows and outflows of municipal and rural clarification plants as well as of a special hospital for lung-diseases and a urological clinic. It was found that coliform bacteria with a threefold and fourfold resistance were dominant in wastewater and surface water and that there was a pronounced shift to strains with a multiple resistance in hospital sewage. The values for the quotient of the single resistance in coliform germs from the wastewater of a lung-disease sanatorium and of germs with multiple resistance in the wastewater from an urological clinic were particularly high. As can be demonstrated, the selective pressure of the different chemotherapeutic agents used for the therapy is effective. (Author's abstract)
W86-00398

ELIMINATION AND RECOVERY OF METAL IONS FROM WASTEWATER - A SURVEY (ELIMINIERUNG UND RUCKGEWINNUNG VON METALLIONEN AUS ABWASSERN - EINE UBERSICHT),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
R. Kummel, F. Winkler, and R. Beck.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 227-237, 1984. 6 Fig, 16 Ref.

Descriptors: *Heavy metals, *Wastewater treatment, Metals, Ion exchange, Recycling, Membrane processes, Chemical treatment, Ultrafiltration.

The present state and the trends in the recovery of heavy metals from wastewaters are presented. The classical precipitation techniques are unsatisfactory due to increases in solubility in the presence of impurity ions and/or complexing agents. At present, ion-exchange processes constitute the most frequently used method of metal recycling with an effective enrichment of metal ions. For the effective separation of metals from solutions of a low concentration, electrolytic reduction demands large electrode surface areas. In cells with fixed-bed or fluidized cathodes one can obtain specific electrode surface areas of some 1000 sq m/cu m. For the future, processes of extraction and especially membrane separation will gain in importance. In the past few years, a large number of highly selective metal extracting agents as well as liquid membrane permeation with suitable carriers were developed. Combinations of membrane separation processes with chemical reactions may attain the same importance, as e.g. ultrafiltration in connection with the fixation of metal ions to water-soluble polymers. In the long run, techniques will prevail which will not only result in metal enrichment but also in the recovery of the raw material water. (Author's abstract)
W86-00410

POSSIBILITIES OF THE CORRELATION OF DIFFERENT WATER ANALYSIS METHODS (MOGLICHKEITEN DER KORRELATION UNTERSCHIEDLICHER WASSERANALYSEN-VERFAHREN),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
For primary bibliographic entry see Field 5A.
W86-00411

POSSIBILITIES OF THE AFTERPURIFICATION OF WASTEWATERS FROM THE PRODUCTION OF ARTIFICIAL LEATHER WITH THE AID OF ALGAE. PART 2 (MOGLICHKEITEN DER NACHREINIGUNG VON ABWASSERN AUS DER KUNSTLEDERPRODUKTION MIT HILFE VON ALGEN, TEIL 2),
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Chromek, J. Kupec, P. Marvan, and M. Mladek.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 521-530, 1984. 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Biological wastewater treatment, *Industrial wastewater, *Algae, *Artificial leather industry, Wastewater treatment, Dimethylamine, Phosphorus, Nitrogen, Scenedesmus.

An attempt was made to use the alga Scenedesmus quadricauda for the purification of wastewaters from the production of artificial leather. The dimethylamine contained in these wastewaters is continuously decomposed and the remaining nitrogen-containing residuals are used as a nutrient source for the production of algal biomass. In continuous experiments with wastewaters, dimethylamine and its metabolites showed a pronounced inhibiting effect. In practice, a longer retention time in the reactors as well as a sufficient proportion of municipal wastewater are required in order to avoid a limiting of growth due to a phosphorus deficiency. Information is given on other investigations performed on the purification of artificial leather wastewaters with the aid of the biological nitrogen elimination under specific conditions with a successful denitrification of up to 95%. (Author's abstract)
W86-00418

MIXING CHARACTERISTICS AND PERFORMANCE OF THE ANAEROBIC UPFLOW BLANKET FILTER (UBF) REACTOR,
Biotechnology Research Inst., Ottawa (Ontario).
R. Samson, and S. Guiot.
Journal of Chemical Technology and Biotechnology, Vol. 35B, No. 1, p 65-74, March, 1985. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Upflow blanket filter, *Mixing, *Wastewater treatment, Chemical oxygen demand, Filtration, Anaerobic digestion, Biological wastewater treatment.

Mixing characteristics (using a radioactive tracer) and reactor performance of the upflow blanket filter (UBF) reactor operated at different loading rates (up to 32 kg chemical oxygen demand (COD)/cu m/day) were compared. The results indicated that mixing profiles of the reactor operated with effluent recirculation and without biomass were of the perfectly mixed type. Operation without recirculation resulted in about 18% dead space. The filter made of plastic rings and located in the top third of the reactor had no negative effect on reactor mixing. Operation at loading rates of up to 25 kg COD/cu m/day permitted a soluble COD removal rate of 95% with a methane production rate of 5.9 cu m/cu m/day. At higher loading rates, the efficiency of COD reduction decreased with a decrease of the specific acetoclastic activity to 0.5 kg acetate removed per kg volatile suspended solids (VSS)/day. At all loading rates studied it was observed that the performance was not related to the mixing characteristics, which had remained of the perfectly mixed type with an occasional small dead space (below 10%). The good mixing characteristics of the UBF reactor coupled with the high biomass content and the effective action of the filter make this reactor one of the most promising designs for the treatment of soluble wastes. (Author's abstract)
W86-00423

ALGAL-BIOMASS RACEWAY SYST PARTIALLY TREATED WASTEWATER IN THE TROPICS,
Hawaii Univ. at Manoa, Honolulu. Dep cultural Engineering.
P. Y. Yang, and S. Y. Nagano.
Transactions of the American Society o tural Engineers, Vol. 28, No. 2, p 542-54 April, 1985. 4 Fig, 6 Tab, 16 Ref.

Descriptors: *Wastewater treatment, wastes, *Algal-biomass raceway system regions, Farm wastes, Ammonia, B oxygen demand.

The algal-biomass raceway system for mixed algae and bacteria from anaero gested effluent and settled supernata swine wastewater was compared with t stabilization processes on the basis of B ing rates, percent removal efficiency a consumption of kilowatt hour input per al of BOD5. The four aerobic systems w tion ditch, algal-biomass raceway, facul dation pond, and aerated lagoon. The ditch and algal-biomass raceway acc much higher BOD5 loading rates than facultative oxidation pond or aerate Overall removal efficiencies were gene for all four systems. The algal-biomass s closely resembles the aerated lagoon in BOD5 since both have similar energy co values. The main advantage of the alg system over the aerated lagoon system is three-fold higher BOD5 loading rate t used. Another advantage of using alg systems is in removing NH4-N. Its rem ciency is 65.8% at a loading rate of 0.02 Its removal efficiency is within the ra 80% reported for the oxidation ditch a higher than the 60% of the aerated addition, the algal-biomass raceway s vides a lower land requirement for except for the oxidation ditch. The alg raceway can handle almost three times loading rate applied to the aerated lagoc only two-thirds the land area. (Baker-IV
W86-00482

STUDIES OF THE HYDRODYNAM ERTIES IN BIOLOGICAL CLARI PLANTS USING RADIOTRACERS,
Akademie der Wissenschaften der DDI Zentralinstitut fuer Isotopen- und St chung.
H. G. Koennecke, D. Luther, K. Koepp Schoen, and H. Ulrich.
Acta Hydrochimica et Hydrobiologica No. 4, p 431-434, 1984. 5 Fig, 6 Ref.

Descriptors: *Biological wastewater *Hydrodynamics, *Radioactive Wastewater treatment, Bromine radioisc tivated sludge process, Optimization, M studies.

Employment of Br-82 as a tracer, com mathematical analysis of results, was u mize performance of two sewage treatr in the German Democratic Republic. plant studied involved two pools, of first, an activated sludge chamber with impeller, a volume of 7,670 cu m, and 730 cu m per hr, was analyzed. The se had a throughput of 100,000 cu m pe comprised 8 activated sludge chambers m volume each. Aeration in the second accomplished by tubes placed side-by-s apart, in the activated sludge chambers. shown to be an ideal mixing reactor b equation c=c sub 0 . e (-/MRT), in wh = initial concentration and MRT = dence time. Reversing the impeller's rotation induced a reduction of the by-p 50%, resulting in improved efficiency vated sludge chamber. In plant II, M maximal throughput (625 cu m per activated sludge chamber) is 374 min, 355 min during minimal throughput (12 hr). Neither by-pass flow nor wake found. MRT was abnormal with

roughput in this chamber, so that the regenera- n volume in the chamber will be used for degra- tion of the contents of the sewage during mini- l throughput. Movement of the sewage inlet to front side of the chamber results in a 20% rease in throughput, with a resulting energy ing of 3.5 x 1,000,000 kWhr/a. (Rochester-IVI) 86-00543

DDEL OF A BACTERIAL CULTURE UTILIZ- G A TOXIC SUBSTRATE IN CONTINUOUS OW CONDITIONS,
lgarian Academy of Sciences, Sofia. Inst. za drena Izsledvaniya i Yadrena Energetika.
r primary bibliographic entry see Field 5B.
86-00549

A DEBATES SWITCH FROM THE CARROT THE STICK IN SEWAGE TREATMENT,
L. Stanfield.
tional Journal, Vol. 17, No. 6, p 312-316, Febru- , 1985.

scriptors: *Wastewater treatment facilities, egislation, Funding, Construction, Water pollu- control, Loans, Grants, Pretreatment, Urban as.

1985, Congress must determine the federal gov- ment's role in water treatment when the federal gram that presently contributes a large fraction he money for treatment plant construction ex- s on September 30. Originally, the law offered ds to municipalities to help with construction of nts as a way to gain their cooperation in compli- e. Great strides have been made since the D's in cleaning up household and commercial tes, particularly in small localities. From 1970, re the federal grant program was started, to 2, however, the contribution of municipalities states for wastewater projects has dropped n $2.3 billion to less than $1 billion for projects received no federal aid. Bills are before Con- s to hold the federal contribution for construc- to the present $2.4 billion annually or to ease the size of the program. Another idea is to vert the program from grants to a revolving program. Large cities, which have not bene- d as much as smaller ones under the existing gram because of the difficulties of getting start- n larger projects, now complain that the pro- n should not be cut back just when they are y to begin construction. An additional prob- to be faced is what to do about toxic dis- ges, which originate largely in industry and e not considered an issue when the original n Water Act facilities grants program was gned. Some cities wish to opt out of the ent federal pretreatment program, which is just getting underway, and create their own pro- ns based on performance criteria rather than Environmental Protection Agency's (EPA) available technology' approach. Failure of y cities to submit pretreatment plans on time necessitated an increase in EPA enforcement ity. (Rochester-IVI) -00559

Water Treatment and Quality Alteration

-SELECTIVE ELECTRODES (ISE) - RE- RCH INTO THE POTENTIAL REGULA- N AND APPLICATION IN ANALYSIS ENSELEKTIVE ELEKTRODEN (ISE) - ERSUCHUNGEN ZUR POTENTIALEIN- LLUNG UND ANWENDUNG IN DER ANA- IK),
nische Hochschule 'Carl Schorlemmer' a-Merseburg (German D.R.).
primary bibliographic entry see Field 5A.
-00395

SICO-CHEMICAL CHARACTERISTICS THE USED FILTER SAND AND ITS ROLE HE SEVEN WATER WORKS SYSTEM IN OPICAL REGION,
al Univ. (India). School of Biological Science.
D. Y. Prasad, and D. K. Belsare.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 73-80, 1984. 5 Tab, 8 Ref.

Descriptors: *Water treatment, *Sand filters, *Tropical regions, India, Filters, Particle size, Backwash, Filter regeneration.

The filter-technique equipment of seven water works in a tropical region of India is described. The structure of the filter sand layer, the grain size distribution and the degree of uniformity are compared by means of tables. The uniformity coefficient of a good filter sand is smaller than 1.7. Besides physical properties, also the surface properties of the filter sand grains are of interest. Different analytical methods for determining the incrustation are described. The amount of the filter grain load also depends on age, that is, on the service life of the filter sand. The efficiency of a filter plant is determined also by the regenerating process, that is, by back-wash. This includes the methods of scouring with water only and the backwashing with water/air. In order to remove organic and inorganic matter that might form a coating on sand, it is necessary to drain the filter to rake them and to expose them to dryness once a fortnight. Then they should be immediately washed to get rid of fine dirt. Similarly, each filter should be superchlorinated for one hour. The top layer of sand (15 cm) may be washed in a Nicholds sand washer. Investigations are necessary under tropical conditions to find out the best working system from all points of view. (Baker-IVI)
W86-00399

WATER CHEMISTRY AND MATERIALS ECONOMY (WASSERCHEMIE UND STOFFWIRTSCHAFT),
Technische Univ., Dresden (German D.R.). Sektion Verabeitungs- und Verfahrenstechnik.
M. Schubert, and J. Kaeding.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 117-120, 1984. 1 Ref.

Descriptors: *Water chemistry, *Water quality, Drinking water, Water treatment, Economic aspects, Environmental effects, Energy, Industrial water, Irrigation water.

For solving of the most important problems concerning water quality economy, drinking water supply, industrial water and irrigation water without hazardous or otherwise detrimental substances the available findings and results of specialized research in water chemistry are needed. In the logical continuation of the development to the level necessary for practical application, the experts in the engineering disciplines have to be consulted. The design of the sequence of water treatment processes depends on the aims of the tasks set, and questions are increasingly being raised concerning the possibilities of saving and recovery of energy and raw materials. In the area of production, in the interest of environment protection one already endeavours to achieve a direct or indirect low-waste or non-waste process design. Finally, possibilities of materials and power economy are discussed using the examples of treatment of chemical industry wastewaters and municipal wastewaters. (Author's abstract)
W86-00402

MOLECULAR MASS DISTRIBUTION OF ORGANIC SUBSTANCES IN THE DRINKING WATER OF PRAGUE (MOLMASSEVERTEILUNG DER ORGANISCHEN STOFFE IM PRAGER TRINKWASSER),
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Lehrstuhl fuer Wassertechnolgie und Umweltschutz.
P. Lischke, and J. Chudoba.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 121-129, 1984. 1 Fig, 4 Tab.

Descriptors: *Drinking water, *Organic matter, *Prague, *Czechoslovakia, Jizera, Vltava, Zelivka, Water quality, Gel chromatography, Chemical oxygen demand, Flocculation, Water treatment, Organic carbon.

The water supply of Prague (Czechoslovakia) is based upon three different water resources: artesian groundwater and infiltrate of the Jizera river, water of the Vltava and Zelivka rivers. The processing techniques are different; consequently for the purpose of increasing capacity one has to search for the suitable raw water quality as well as for the optimum treatment process. An essential parameter for this is the contents of organic substances whose mass distribution is investigated by gel chromatography with the aid of Sephadex G-10, G-25 and G-50. With respect to the total load of organic matter the Jizera shows the lowest values, in the Vltava the C.O.D. values are the highest, in the Zelivka the organic carbon shows the highest values. 80% of the organic substances in water have molar masses below 700. By flocculation 60-70% of the C.O.D.-Cr can be eliminated, the optimum removal of the high-molecular substances occurring at pH = 6 and with 50-60 g/cu m aluminium sulfate. (Author's abstract)
W86-00403

CAPACITY OF MACROPOROUS ADSORBER POLYMERS IN THE ELIMINATION OF ORGANIC MICROCONTAMINANTS (ZUM LEISTUNGSVERMOGEN MAKROPOROSER ADSORBERPOLYMERE BEI DER ELIMINATION ORGANISCHER MIKROVERUNREINIGUNGEN),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
H. J. Walther, J. Kaeding, and P. Fechner.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 173-181, 1984. 5 Fig, 4 Tab, 6 Ref.

Descriptors: *Organic compounds, *Adsorption, *Polymers, *Water treatment, Adsorbents, Filtration, Activated carbon, Desorption.

In laboratory experiments the adsorption of eleven different organic substances in water was individually tested in the range of concentration of 0.2-5.0 mg/l on EP 60 and EP 61 (styrene-divinylbenzene, non-polar) and EP 62 and Y 59 (acrylic-acid-ester-divinylbenzene, polar). In batch experiments the elimination at 1-2 g/l adsorber quantity was 35-80%, strongly dissociated anionic substances such as benzoic acid being adsorbed only to a low degree and weakly cationic and undissociated substances being adsorbed well. Within a homologous series, adsorption increases with the molar mass until the pore diameter became too small for the up-take of substances. Under dynamic conditions (filtration technology) an elimination of 90-100% can be expected. As a whole, the adsorption on activated carbon was better in all cases than the adsorption on the polymers. The desorption for the regeneration of the polymers is more difficult the better the substance contained is adsorbed. By repeated loading and regeneration only a slight influence on the adsorption and desorption of a substance was found. (Author's abstract)
W86-00409

DISINFECTION OF DRINKING WATER - A CRITICAL REVIEW (DIE DESINFEKTION VON TRINKWASSER - EIN KRITISCHER UBERBLICK),
Bremer Umweltinstitut fuer die Analyse und Bewertung von Schadstoffen (Germany, F.R.).
B. Stachel, B. Gabel, U. Lahl, and B. Zeschmar.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 499-519, 1984. 4 Fig, 10 Tab, 119 Ref.

Descriptors: *Disinfection, *Drinking water, *Reviews, Chlorination, Trihalomethanes, Chlorine dioxide, Halogenated hydrocarbons, Chloramine, Ozone, Ultraviolet radiation, Water treatment.

In drinking water chlorination about 90% of the chlorine shows an oxidizing effect, 10% results in halogenated reaction products, and ca. 1% results in trihalomethanes. When chlorine dioxide is applied, the trihalomethanes remain below the detection limit, but increasingly polar organic reaction products originate. Chloramine is rarely applied, mostly for storage reservoir waters. Little information about reaction products is available. With the application of ozone one obtains a wide spectrum

of reaction products; the aldehyde contents can be influenced by activated carbon. Especially critical is the formation of persistent epoxides, especially from pesticides. Ultraviolet irradiation is gaining in interest, and in many cases its biocidal effect is superior to that produced by chlorination and ozonation, except for the problem of re-germination in the water supply network. The costs of ultraviolet irradiation are much higher than those of the other techniques; chlorination costs only about one quarter as much as the other chemical disinfection techniques. (Author's abstract)
W86-00417

POTENTIOMETRIC FLUORIDE DETERMINATION IN DRINKING WATER (POTENTIOMETRISCHE FLUORIDBESTIMMUNG IN TRINKWASSER),
Bezirks-Hygieneinspektion und -Inst. Cottbus (German D.R.).
K. Seifert, and W. Klaue.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 377-382, 1984. 4 Tab, 5 Ref.

Descriptors: *Fluorides, *Drinking water, *Potentiometry, Water analysis, Interference.

The measurement is carried out after addition of perchloric acid up to a concentration of 0.45 M perchloric acid, and the results are compared with those obtained in 0.16 M sodium citrate as well as with a gas-chromatographic determination, and they show a good agreement. The detection limit is 0.002 mg/l F(-), the coefficient of variation is nearly 0.01 at 0.85 mg/l F-, independently of whether a direct measurement or a measurement with a standard addition is carried out. The measurement is disturbed by aluminium (III)- and iron(III)-ions. (Author's abstract)
W86-00539

DIURNAL THERMAL STRATIFICATION AND FLOC RISING IN CLARIFLOCCULATORS OF THE TROPICAL WATER WORKS,
Bhopal Univ. (India). School of Biological Science.
D. K. Belsare, and D. Y. Prasad.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 393-398, 1984. 1 Fig, 4 Tab, 4 Ref.

Descriptors: *Flocculation, *Tropical regions, *Thermal stratification, *Water treatment, *Floc rising, Filtration, Aeration, Supersaturation, Dissolved oxygen, Photosynthesis, Phytoplankton.

Water treatment facilities in tropical areas may have difficulties caused by floc rising; the flocs pass on to the rapid sand filters and reduce the filter run. Floc rising occurring during the day-hours (especially in the hot season) in the flocculators was investigated at four tropical water works. This phenomenon is caused by the great heating of the raw water during the daytime. Between 10.00 a.m. and 10.00 p.m., a temperature difference up to 3.7 K between the influent and the effluent of the flocculators occurs during a retention period of 3.5-5 h within the flocculators. Every temperature differences of only 1 K result in floc rising, reducing the filter run by four to seven hours. Oversaturation of the raw water with oxygen by the photosynthetic oxygen production constitutes an additional cause. The aeration of the water at the raw water intake point is recommended to prevent a thermal stratification during the day-hours and at the same time to remove the oxygen oversaturation. The phytoplankton population should also be kept at an optimum level to reduce floc rising. (Moore-IVI)
W86-00541

NITRATE IN DRINKING WATER - PROBLEMS OF HYGIENE AND TREATMENT (NITRAT IM TRINKWASSER - HYGIENISCHE UND AUFBEREITUNGSTECHNISCHE),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
J. Putzien.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 577-593, 1984. 12 Fig, 3 Tab, 14 Ref.

Descriptors: *Nitrates, *Drinking water, *Water treatment, Groundwater pollution, Methemoglobinemia, Carcinogens, Teratogens, Mutagens, Ion exchange, Reverse osmosis, Electrodialysis, Denitrification.

The increasing nitrate concentrations in the ground water and drinking water which are caused by intensified fertilizing lead to the risk of methemoglobinemia of babies and increase the cancerogenic, teratogenic and mutagenic risk for the total population. In the drinking water conditioning the nitrate concentration can be reduced by different techniques. By ion exchange first the SO4-ions and then the nitrate-ions are removed. The exchange is very favorable for HCO3(-) and the regeneration by means of carbon dioxide and CaCO3, for which a mass balance of substances is given. With 0.55 DM/cu m also the reverse osmosis in a mixture with raw water is practicable and also electrodialysis can be applied, whereas the biological techniques of the heterotrophic or autotrophic denitrification still include unsolved technological problems due to the necessity of an organic substrate or of H2. The special features of each of these techniques and the hygienic and also the corrosion-chemical consequences are indicated. (Author's abstract)
W86-00545

5G. Water Quality Control

ENVIRONMENTAL ASPECTS OF ARTIFICIAL AERATION AND OXYGENATION OF RESERVOIRS: A REVIEW OF THEORY, TECHNIQUES, AND EXPERIENCES,
Tetra Tech, Inc., Bellevue, WA.
R. A. Pastorok, M. W. Lorenzen, and T. C. Ginn.
Technical Report E-82-3, May 1982. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 277 p, 26 Fig, 21 Tab, 327 Ref, Append.

Descriptors: *Water quality control, *Aeration, *Reservoirs, *Lakes, *Water circulation, *Destratification, *Mixing, Hypolimnion, Reservoir releases, Outlets, Tailwater, Oxygenation, Pumps, Aquatic life, Algae, Phytoplankton, Biomass, Fish, Zooplankton, Eutrophication, Stratification, Thermal stratification.

This report includes (1) a literature review of aeration/circulation techniques for reservoirs, (2) a statistical analysis of alternative artificial circulation methods, (3) morphometric and water quality data for 107 reservoirs, and (4) an evaluation procedure for alternative management applications in reservoirs. Artifical destratification usually elevates dissolved oxygen levels in a lake by bringing anoxic bottom waters to the surface for aeration from the atmosphere. Oxygenation may precipitate phosphates and inhibit nutrient release from sediments, which may be counteracted by invertebrate activity. If pumps are undersized or destratification is untimely with respect to algal blooms, oxygen deficits can be aggravated. Mixing at the surface usually reduces algal biomass per unit area of lake surface, lowers the pH in the upper waters, replaces blue-green algae with green algae, increases the zooplankton and benthic macroinvertebrate populations, and produces short-term increases in fish growth and yield. Hypolimnetic aeration improves water quality without disrupting thermal stratification. Although hypolimmetic aeration has limited effect on algal blooms, the risk of adverse effects is lower. Oxygenation of downstream reaches can be accomplished by hypolimnetic aeration, localized mixing, aeration in the outlet works, and tailwaters aeration.
W86-00327

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN: DRAFT RESPONSE AND INCIDENT TRACKING PROCEDURES.
Michigan Dept. of Natural Resources, Lansing. Water Quality Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-116087. Report MI/DNR/GW-82/05, July 1982. Tasks 6 and 3. 13 p. 3 Fig. Contract/Grant No. P00

Descriptors: *Groundwater, *Groundwate agement, *Groundwater pollution, Water Resource management, Water pollution Regulations, *Michigan.

Several management tools are needed to state response to incidents of groundwate tion because of the large number of inci which state response actions may need to formed. Two primary management to Michigan are described in this document management tools are: (1) General Respon cedures, guidance as to how and when s tions are initiated in response to incid groundwater pollution concern; and (2) Tracking Procedures, and information r ment system to facilitate the recording, and distribution of information on the s each contamination incident. Draft Respo Incident Tracking procedures are presen will be further refined as the project p
W86-00362

IMPACT OF THE SILVER CARP POPHTHALMICHTHYS MOLITRIX VA THE ECOSYSTEM OF CARP PONDS,
Instytut Rybactwa Srodladowego, Pi (Poland). Dept. of Pond Management.
For primary bibliographic entry see Field 5
W86-00439

CHESAPEAKE BAY: SAVING A NAT RESOURCE THROUGH MULTI-STATE ERATION,
Bureau of National Affairs, Inc., Washingt Dept. of Environment, Safety and Health S
For primary bibliographic entry see Field 6
W86-00572

POINT SOURCE WATER QUALITY CO IN VIRGINIA: CHOICES FOR THE C PEAKE,
Chesapeake Bay Foundation, Inc., Richmo
J. M. Watson.
Virginia Journal of Natural Resources La 4, No. 2, p 263-300, 1985. 203 Ref.

Descriptors: *Water pollution control, quality control, *Chesapeake Bay, *Virgini ernmental interrelations, Wastewater tre Nutrients, Water quality standards.

Water quality degradation in the Chesapea early judicial attempts to remedy water damage in Virginia, state legislative appro water quality protection, federal water qua islation, Virginia's water quality control p and legal challenges to its implementation, Virginia Chesapeake Bay initiatives are re and recommendations are made that wou retard the deterioration of the Bay. Emp placed on point sources of pollution. Tw gent policy trends are apparent: (1) the rec by the Environmental Protection Agency of the need for advanced wastewater treatr nutrients and toxic substances, particularly James River and Hampton Roads areas, implies technology forcing standards and tions, and (2) the Virginia Supreme Court's tion of the State Water Control Board exc to the enforcement of standards and lim that can be met with existing technology. I more, the State Water Control Board, aft efforts in several areas, has largely abando dressing nutrient problems through the Pollution Discharge Elimination System p Recent cooperative efforts among jurisdicti rounding the Bay, in response to the EPA peake Bay program study, make now a go for renewed attempts to control pollutic Virginia Chesapeake Bay initiatives may able to be meaningfully implemented, h until the Virginia General Assembly m reverse the holding in the County Utiliti which limits action to available technolo not allowing technology forcing. In additio ing of programs should be increased for e

an up the Bay, and day-to-day activities of orcement, maintenance, repair, personnel train-, and continued research and application should continued. (Rochester-IVI)
6-00575

WATER RESOURCES PLANNING

. Evaluation Process

'ARIAN AND STREAM ENHANCEMENT NAGEMENT AND RESEARCH IN THE CKY MOUNTAINS,
rmountain Forest and Range Experiment Sta-, Boise, ID.
S. Platts, and J. N. Rinne.
th American Journal of Fisheries Management, 5, No. 2A, p 115-125, Spring, 1985. 1 Fig, 1 , 71 Ref.

criptors: *Riparian waters, *Rocky Mountains, eam enhancement, Management, Streams, er management, Planning, Land use, Stream-s, Vegetation, Aquatic animals.

most important research efforts conducted to are reviewed and evaluated concerning their uacy and effectiveness of future stream en-ement projects. The available research results are stratified by components that comprise the tic habitat: riparian, water column, stream , channel, and biotic. The importance of ripar-cosystems was first addressed seriously in the 1970's. Because riparian vegetation responds dly to changes in management, in many cases ration can be made to damaged riparian habi-with the time required depending on climatic itions, soil fertility and surrounding land use. orts are discussed which touch on the follow-reas of interest: importance of vegetation in ian areas, fencing riparian areas, stream reha-tion (with emphasis on water column, and nel characteristics), rehabilitating aquatic (threatened and endangered fish, nonthrea-l fish, and macroinvertebrates), and proposals ensible stream research and enhancement. watershed research has been oriented toward roduction of specific products such as forage, timber, and minerals. Such research has usu-been aimed at evaluating the impacts of com-ty production on other values such as fishing. arch aimed at mitigating or rehabilitating de-d aquatic environments needs special atten-n the next decade. Emphasis should be placed etermining how to incorporate compatible ng strategies into land management, conduct-ong term studies on stream enhancement ures to determine success, proper location, daptability to the different stream conditions, onducting studies to better understand how cement projects affect fish communities and environments. (Baker-IVI)
00588

Water Demand

ER SUPPLY STUDY: SACO AND SOUTH-MAINE RIVER BASINS.
rup and Parcel and Associates, Inc., Boston,

able from the National Technical Information e, Springfield, VA 22161 as ADA 120116. of Engineers Water Supply Study, March 64 p. 16 Tab, 2 Maps, 14 Ref. Contract/ No. DACW33-80-C-0085.

iptors: *Water demand, *Water supply, r resources development, *Water scarcity, conservation, Groundwater availability, dwater, Maine, Planning.

l very serious deficiencies of water supply been identified in the southern Maine coastal pecifically the seven communities of Kittery, York, Wells, Kennebunk, Arundel and Ken-kport. There are problems meeting both peak l demand and peak daily demands. A short-term solution to these peak deficits can be achieved in most cases through the use of equalizing storage facilities, peak pricing and regulation measures. Long-term demand projected to the year 2030 can be met by combination of conservation and increased use of Saco River water. There is a danger of future contamination of the upper Saco River that is currently being examined by the states of Maine and New Hampshire.
W86-00371

ISSUES IN THE JAMES RIVER CORRIDOR,
Richmond Regional Planning District Commission, VA.
For primary bibliographic entry see Field 6G.
W86-00582

6E. Water Law and Institutions

MAJOR PROJECT IN THE AGE OF THE ENVIRONMENT: OUT OF CONTROVERSY, COMPLEXITY, AND CHALLENGE,
Corps of Engineers, Mobile, AL. Mobile District.
N. D. McClure, IV.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 15-24, 1985. 2 Tab, 17 Ref.

Descriptors: *Water resources development, *Tennessee-Tombigbee Waterway, *Environmental effects, *Legal aspects, Regulations, Planning, Waterways, Construction.

Throughout its development, the Tennessee-Tombigbee Waterway (Tenn-Tom) has experienced a turbulent existence. It has been subjected to considerable scrutiny from all three branches of the federal government. Central among these challenges was the litigation involving allegations under the National Environmental Policy Act. Environmental issues and controversies related to the Tenn-Tom included the following: hydrogeology; basin connection and water transfer; water quality; sedimentation and erosion; change of free flowing streams to impoundments; disposal of excavated material; loss of wildlife habitat; cultural resources; navigation impacts; and indirect impacts such as induced land use changes and alterations to the socioeconoic situation. (Baker-IVI)
W86-00333

EPA DEBATES SWITCH FROM THE CARROT TO THE STICK IN SEWAGE TREATMENT,
For primary bibliographic entry see Field 5D.
W86-00559

INDIAN ALLOTMENT WATER RIGHTS,
Colorado Univ. at Boulder. School of Law.
R. B. Collins.
Land and Water Law Review, Vol. 20, No. 2, p 421-457, 1985. 180 Ref.

Descriptors: *Indian rights, *Water rights, *Tribal lands, Native Americans, Legal aspects, Indian reservations, Federal jurisdiction, State jurisdiction.

Allotted tribal lands create troublesome questions for western water lawyers. In this article the author reviews the history of basic Indian reservation water rights created by the Supreme Court's landmark decision in Winters v. United States. The disposition of those rights when reservation lands are allotted are then explained. Finally, the difficult issues that arise when allotted lands pass from the federal trust, become subject to state law, and are transferred to non-Indians, are discussed. (Author's abstract)
W86-00560

FORFEITURE PROCEEDINGS IN WYOMING WATER LAW: THE LEGISLATURE REVIVES PRIVATE STANDING,
E. W. Harris.
Land and Water Law Review, Vol. 20, No. 2, p 459-474, 1985. 113 Ref.

Descriptors: *Wyoming, *Water rights, *Private standing, *Forfeiture, Prior appropriation, Beneficial use, Legal aspects, Standing.

Wyoming water law, like much of that in the United States, was based initially on a simple prior appropriation concept: those who put water to beneficial use first were entitled to its use. This provided security for investors and encouraged the most productive economic use, thus benefitting society in general. State administration improved this pioneer concept by adding an orderly way to keep track of dates of appropriation and to recognize challenges to others' water rights. Water rights that are forfeited return to state ownership, and can thus be appropriated by someone else. Prior to 1984, standing to bring forfeiture proceedings was gained merely by showing that the plaintiff was 'affected' within the meaning of the forfeiture statute. In 1984 the Wyoming Supreme Court in Cremer versus State Board of Control appeared to change the definition of standing. In the decision in Platte County Grazing Association versus State Board of Control, the Court made it clear that the junior appropriator had to show injury to have standing to attack a senior's rights. This decision represented a major change in Wyoming water law that did not conform to precedent. The Wyoming Legislature in 1985 amended the forfeiture statute to grant standing to make it clear that 'affected' in the law meant either benefitted or injured, not just the latter, as the Court had held. (Rochester-IVI)
W86-00561

SIXTH CIRCUIT'S UNSETTLING INTERPRETATION OF THE CORPS OF ENGINEERS' WETLAND DEFINITION. UNITED STATES V. RIVERSIDE BAYVIEW HOMES, INC., 729 F. 2D 391 (6TH CIR. 1984), CERT. GRANTED, 53 U.S.L.W. 3597 (U.S. FEB. 19, 1985) (NO. 84-701),
K. Lamere.
Land and Water Law Review, Vol. 20, No. 2, p 475-484, 1985. 90 Ref.

Descriptors: *Wetlands, *Judicial decisions, *Riverside Bayview Homes, *Michigan, Clean Water Act, Flooding, Fill permits, Navigable waters.

Riverside Bayview Homes, Inc., of Michigan (USA) was enjoined by district court from filling an 80-acre wetland north of Detroit as a result of an enforcement proceeding filed by the Department of the Army, Corps of Engineers (Corps) in compliance with the Clean Water Act (CWA). On a second appeal, after once sending the case back to district court, the Sixth Circuit Court reversed the holding of the district court, interpreting the CWA definition of wetlands to require 'frequent flooding by water flowing from navigable waters' as defined in the Act. The court held that the definition did not cover 'inland lowlying areas such as the one in question here that sometimes become saturated with water.' The Sixth Circuit finding conflicts with those of other circuit courts, and it appears to ignore specific, clear language in the CWA, which has been steadily expanded since its passing to define wetlands more broadly. The court established a jurisdictional limitation (navigable waters) that does not appear in CWA itself, it ignored the words 'or saturated' (regardless of mechanism of inundation) that appear in the Act, it ignored the administrative record previously established in wetland cases, and it cited the taking issue involved in Kaiser Aetna versus United States, which was unjustified. The Sixth Circuit's ruling in Riverside raises questions about the Corp's wetlands definition and regulatory permitting process. The ruling contradicts both accepted congressional intent of the CWA and wetlands case law. The Supreme Court has agreed to review this decision. (Rochester-IVI)
W86-00562

VIOLATION OF NEPA ENVIRONMENTAL IMPACT STATEMENT REQUIREMENT EXCUSED BY SUBSEQUENT AGENCY CONSIDERATION OF ALTERNATIVES. FRIENDS OF THE RIVER V. FEDERAL ENERGY REGULATORY COMMISSION, 720 F.2D 93 (D.C. CIR. 1983),

E. Merila.
Land and Water Law Review, Vol. 20, No. 2, p 486-492, 1985. 56 Ref.

Descriptors: *Environmental Impact Statement, *Hydroelectric power, Calaveras County, California, Dams, Alternative planning, National Environmental Policy Act.

In the case of Friends of the River (FoR) versus Federal Energy Regulatory Commission (FERC) the United States Court of Appeals, District of Columbia Circuit, held that FERC did not violate National Environmental Policy Act (NEPA) requirements, but that a remand of the case was unnecessary because FERC had discussed the subject at issue in its response to a previous complaint. FoR originally petitioned FERC for a rehearing on the Environmental Impact Statement (EIS) prepared in support of building a dam in Calaveras County, California (USA), because the final EIS contained only two sentences on the alternative of purchasing power from other utilities, a procedure suggested by FoR in their comments on the draft EIS. In denying the request for a rehearing, FERC addressed the purchase of power in its response, but did not reopen the EIS procedure. FoR contended that FERC 'neglected its duties' under NEPA by failing to consider and present the alternative in the EIS itself. The court did not agree with the FoR contention, even though its holding clearly conflicts with NEPA's procedural commands and the policies underlying these procedures. The three cases cited by the court, Scenic Hudson Preservation Conference versus Federal Power Commission, Swinomish Tribal Community versus FERC, and Warm Springs Dam versus Gribble, did not really support the court's holding. The result contrasts with National Wildlife Federation versus Andrus, where the court held that the reasons for accepting or rejecting alternatives must be set out in the EIS, and not in papers filed with the court. The court in this case had concluded that the violations required a remand, but did not require it because the FERC submission had remedied the defects in the final EIS. This outcome is contrary to the intent of Congress in adopting NEPA, and is not supported by precedent. It indicates that an EIS can be a pro forma rationalization, rather than an important tool in an agency's decision-making process. (Rochester-IVI)
W86-00563

WHEN WATER QUANTITY REGULATION IS NOT WATER QUANTITY REGULATION. RIVERSIDE V. ANDREWS, 568 F. SUPP. 583 (D. COLO. 1983),
T. Vincelette.
Land and Water Law Review, Vol. 20, No. 2, p 523-533, 1985. 79 Ref.

Descriptors: *Riverside Irrigation District, *Colorado, *Water quality control, *Regulations, Fill permits, Dam construction, State jurisdiction, Federal jurisdiction, Environmental effects.

Riverside Irrigation District (Colorado) brought suit against the Army Corps of Engineers (Corps), claiming that the Corps lacked authority to deny a request for a dredge and fill permit for their dam project because they were entitled to an automatic nation-wide permit for their dredge and fill activities. Their complaint (Riverside versus Andrews) was denied in Colorado district court. The Corps contended that denial of the permit represented proper exercise of its authority to regulate water quantity, which would be affected by the project once it began operation. The Corps argued that it was exercising federal police powers by considering the project's environmental effects, which in this case included destruction of habitat of the whooping crane (an endangered species), and that the permit was denied on these grounds. The district court held that the Corp's action was correct. Riverside had argued that the Corp's authority was limited to the construction phase of the project only, and did not extend to the operational phase, in which minimal flow requirements, if there were to be any, would be determined by state water law, rather than federal laws. The court noted in Riverside versus Andrews: 'although the defendant's actions may have a substantial effect on state water rights, such is the case with many federal laws which particularly pre-empt state water laws.' Riverside's appeal of the district court decision is pending in Tenth Circuit Court. (Rochester-IVI)
W86-00564

EXERCISE OF FEDERAL JURISDICTION IN RESERVED WATER RIGHTS LITIGATION. UNITED STATES V. ADAIR, 723 F.2D 1394 (9TH CIR. 1983), CERT. DENIED SUB. NOM. OREGON V. UNITED STATES, 104 S. CT. 3536 (1984),
M. Reynolds.
Land and Water Law Review, Vol. 20, No. 2, p 511-521, 1985. 75 Ref.

Descriptors: *Federal jurisdiction, *Litigation, *Water rights, Reservation doctrine, Indian reservations.

When a suit originally filed by the United States in Oregon district court to obtain a declaration of water rights within the area once part comprising the Klamath Indian Reservation was adjudicated in favor of the federal government, the state appealed in Ninth Circuit Court on the grounds that the district court should have dismissed the suit. The Court of Appeals held that when a district court has proceeded to determine the nature and priority of water rights that are governed by federal law in a case involving Indian litigants, its decision should not be reversed. The Ninth Circuit court determined in this appeals case (United States versus Adair) that all three exceptions applying in the Arizona versus San Carlos Apache Tribe case also applied here. The court rejected the state's argument that the exercise of jurisdiction would be contrary to the policy of the McCarran Amendment. Although, at first glance, it appears that the Ninth Circuit correctly applied the San Carlos exceptions to the facts of Adair, the facts do not fit the exceptions ('express agreement to stay', 'adjudication of Indian rights', and 'delay in the motion to dismiss'). The court's dilemma in Adair was that, by the time the appeal was filed, the district court had taken 8 years to complete its work, and holding for the plaintiff would have meant starting over. In Adair, the district court should clearly have abstained under the Colorado River abstention doctrine, but did not. Not only did United States versus Adair undermine the Colorado River doctrine, but it violated the Supreme Court's guidelines in San Carlos. To avoid the dilemma presented by this case in the future water rights attorneys should appeal the denial of dismissal motion immediately, not after the completion of the district court's work. (Rochester-IVI)
W86-00565

COASTAL ZONE MANAGEMENT ACT: A PROTECTIVE MANDATE,
Natural Resources Defense Council, Inc., Washington, DC.
S. Chasis.
Natural Resources Journal, Vol. 25, No. 1, p 21-30, January, 1985. 51 Ref.

Descriptors: *Coastal Zone Management Act, *Legislation, Coastal areas, Standards, State jurisdiction, Federal jurisdiction, Resources management.

The rationale of the Coastal Zone Management Act (CZMA), its provisions, it problems of statutory structure and implementation, and the continued importance of its purpose are discussed. Review of the original debates at the time the Act was passed make clear the Congress recognized the deteriorating condition of coastal resources and the inability of state and local governments alone to effectively deal with the situation. A list of national coastal objectives was drawn up that included protection of natural systems, minimization of loss of life and property due to coastal development, and coordination and simplification of government procedures, among seven original items. Later, waterfront economic development and management of living marine resources were added, but attempts have been made to deny funding for this already broad responsibility on the grounds that the federal role is over, and that the states could and would assume full responsibility for funding the p
Thirty states (including those bordering t
Lakes) and five territories are eligible fo
funds under the CZMA. Responsibility fo
istering the Act is assigned to the Secr
Commerce, who designated the National
and Atmospheric Administration (NOAA
agency to manage the program. Within
the responsibility resides in the Office o
and Coastal Resources Management. The
very broad, and participation is volun
number of states have no coastal plans
others the coastal programs are ineffectiv
al implementation has been weak in the
standards for program approval, stand
review of state performance, and a lack o
about program benefits to the states. T
existing at the time the CMZA was o
proposed still exist. State and local p
should be improved as a protection ag
possible loss of the CMZA program, but
of the great national importance of the co
program should not be terminated. (R
IVI)
W86-00566

**CZM FROM THE STATE PERSPECTIV
NEW JERSEY EXPERIENCE,**
Kinsey (David N.) Associates, Princeton,
D. N. Kinsey.
Natural Resources Journal, Vol. 25, No.
102, January, 1985. 108 Ref.

Descriptors: *Coastal Zone Managem
*New Jersey, Resources management,
areas, Land use, Nuclear powerplants
areas.

The experience of the State of New Jers
with implementation of its responsibiliti
the federal Coastal Zone Managem
(CZMA) is reviewed, including: incentiv
CZMA for coastal states, contents of t
coastal management program, the Coas
Facility Review Act (CAFRA, New Jers
coastal zone management legislation), cr
evaluating state coastal management prog
case examples of the functioning of New
management effort. Among major issues
dealt with under CAFRA are the grow
Atlantic City region in the casino era
preservation and hotel-casino design,
energy and coastal land use, and beach a
portation regulation and improvement.
result of the New Jersey experience unde
is a firmly established, detailed, and
framework for coastal decision making
agencies, local governments, and the priv
on a wide variety of uses of coastal resc
light of the New Jersey experience the inc
'federal consistency' has proven only a
control which could block a federal ac
could not require a federal agency to ac
tively in a manner desired by a coastal
wide variety of regional and national in
the coastal zone are now being conside
explicitly and with greater results than b
actment of the federal Coastal Zone Ma
Act. No constituency exists for coastal z
agement by government per se, because
stituency has its own opinion about the be
and there is a general anti-regulation senti
desire for local control. The technical
provided by the federal coastal bureau
extremely important and should be greatl
ed; the financial assistance to and through
local governments under the CZMA i
(Rochester-IVI)
W86-00567

**CZM IN CALIFORNIA, OREGON, AN
INGTON,**
Oregon Univ., Eugene.
R. G. Hildreth, and R. W. Johnson.
Natural Resources Journal, Vol. 25, No.
165, January, 1985. 346 Ref.

Descriptors: *Coastal Zone Management,
nia, *Oregon, *Washington, Public part

ning, Governmental interrelations, Resources gement, Enforcement.

coastal zone management (CZM) activities of ay Conservation and Development Commis- (San Francisco), and the state programs of rnia, Oregon and Washington are discussed ms of public participation, state and local nment relationships, enforcement of program rements, federal consistency with approved programs, and development in hazardous l areas. Two of the three states which dele- substantial coastal planning responsibilities to governments experienced significant delays in leting the process. The experience suggests nany local governments cannot or will not the technical requirements of comprehensive l planning, even with significant federal and financial support. Inadequate enforcement of am requirements has been the most common sm of CZM in all three states; reduction of ograms' comprehensiveness, both in terms of addressed and geography, is one possible on to the enforcement problems. A central nt of all West Coast programs has been the that development on shorelines and in tidal bmerged areas should not be allowed unless re 'water dependent.' Experience has shown e water-dependency concept describes a pri- rather than absolute rule. Successful imple- tion of the water-dependency concept re- a strong monitoring and enforcement effort the local government level. The significant that programs have had in improving coastal nanagement in the three states over the last raises legitimate expectations for their success. Monitoring problems are unlikely solved by any strikingly new institutional res. (Rochester-IVI)
0568

ING INSTITUTIONAL ARRANGE- S AND IMPLICATIONS FOR MANAGE- OF TOKYO BAY,
ama City Univ. (Japan).
i, and K. Hanayama.
l Resources Journal, Vol. 25, No. 1, p 167- nuary, 1985. 3 Fig, 3 Tab, 68 Ref.

ptors: *Tokyo Bay, *Japan, *Resources ement, Governmental interrelations, Institu- constraints, Water quality control, Bays, s, Marine environment, Ports, Fisheries, eclamation.

Bay has been central to Japan's economy ng time; in the middle of the 18th Century ulation of Tokyo was 1.3 million. The area ding Tokyo Bay produced 22% of Japan's dustrial output in 1980. Although the cen- vernment is located in Tokyo, most of the nt decisions concerning the ecosystem of are made by local governments, which at two levels: prefecture and community. stem of managing the marine environment ources of Tokyo Bay is characterized by a network of ad hoc measures taken by and local governments with respect to dif- uses, including land reclamation, fisheries, ction of port facilities and industrial plants, nance and management of port facilities, ion of marine pollution, and control of total nt load. The national government has taken ction to prevent or reduce deterioration of uality and to protect the marine environ- he Environment Agency has been ineffec- has limitations upon its administrative ac- and authority, and other government agen- ve limited its powers. Local governments own 'quality standards' or 'emission stand- hich in many cases are stricter than those he central government. Enforcement typi- kes the form of guidance, with punishment sed as a last resort. Generally, Japanese mental policies have concentrated on pollu- tement, with little attention given to main- or enhancement of environmental quality ies'). Tokyo Metropolis, Kanagawa Prefec- okohama City, and Chiba Prefecture have dently developed and regulated their por- the bay area. Public participation in deci- garding use of Tokyo Bay has been limited in the past, particularly at the stage of issue formulation. There is a lack of integration and comprehensiveness in the management of the Tokyo Bay marine environment and resources. Establishment of a single, comprehensive agency probably is not the solution at present. An inter-prefectural forum to coordinate government activities is more practical. (Rochester-IVI)
W86-00569

ENVIRONMENTAL MANAGEMENT OF THE MALACCA/SINGAPORE STRAITS: LEGAL AND INSTITUTIONAL ISSUES,
Resource Systems Inst., Honolulu, HI.
M. J. Valencia, and A. B. Jaafar.
Natural Resources Journal, Vol. 25, No. 1, p 195-232, January, 1985. 3 Fig, 3 Tab, 146 Ref.

Descriptors: *Malacca/Singapore Straits, *Legal aspects, *Institutional constraints, *Environmental policy, Singapore, Malaysia, Indonesia, International law, Law of the sea, Water pollution control, Navigation.

The Malacca/Singapore straits, an area of high ship traffic volume, petroleum development, and trading, involves three national governments: Singapore, Malaysia, and Indonesia, each of which has its own priorities and limitations in dealing with management of the environment. The involved states have not harmonized their respective environmental policies and regulations, nor have any of them introduced the necessary legislation required by the Convention on Law of the Sea. Contingency plans for dealing with marine pollution due to accidents exist at the national level, under the aegis of the Association of Southeast Asian Nations, and in the form of the Malacca-Singapore traffic separation scheme. Specific legal issues that may arise in this region include: spatial interference with transit passage, innocent passage versus transit passage, extension of traffic lanes, duties of port states, traffic management, prohibited zones for tanker operation, tanker safety standards (special design and equipment requirements), different standards for vessels that frequently navigate the Strait versus those that only do so occasionally, imposition of charges, increased liability and compensation requirements, and required contingency plans. A review of the environmental laws and updating of rules and regulations of the three states to implement the relevant provisions of the Law of the Sea Convention would provide the necessary stimulus for harmonizing of laws. Another approach would be to harmonize practices and reconcile pollution control regulations only with respect to major pollutants. Other alternatives include ratification or accession to major international conventions of environmental relevance, development of a joint contingency plan for the Malacca Strait, and establishment of a compensation fund. Possible bases for allocation of contingency fund contributions are risk, geography, economic position, and benefits derived from the Straits. A joint management authority is the most idealistic solution and is not likely at present. (Rochester-IVI)
W86-00570

ENVIRONMENTAL MANAGEMENT IN A NORTH SEA COASTAL ZONE: LAW, INSTITUTIONS AND POLICY,
Durham Univ. (England).
L. Guruswamy.
Natural Resources Journal, Vol. 25, No. 1, p 233-242, January, 1985. 33 Ref.

Descriptors: *North Sea, *England, *Coastal Zone Management, *Institutional constraints, *Legal aspects, *Environmental policy, Resources management, International law, Water pollution control, Alternative planning.

A project is described that will attempt to formulate an integrated environmental and resource strategy for the North Sea based on the World Conservation Strategy by analysis of the case of the coastal zone of the County Cleveland in the United Kingdom. The site is a formerly diverse marine habitat now 'reclaimed' for industrial development, agriculture, and utilities. The proposed study will be conducted in two phases. First, applicable law will be researched, whether it be United Kingdom, European, or international law, and the degree to which the laws are fragmented or integrated will be determined. The law, together with the institutions and policies relevant to pollution control and resource conservation, then will by analyzed, clarified, and restated. In the second stage of the project an attempt will be made to apply the strategy in a practical way to achieve given objectives. In the first stage, uses natural resources in County Cleveland will be determined, the extent and nature of fragmentation or integration among pollution control, town and country planning, and conservation of species and habitat will be examined, and certain aspects of the European Parliament's relationship to the problems under consideration will be discussed. Conflicts of objectives within individual agencies, eg, water authorities, will be examined. In the operational phase of the project, an interdisciplinary approach will be taken to topics such as the following: an assessment of policy criteria and priorities in selecting use objectives for natural resources, a determination of sources of relevant pollution and wastes, consideration of alternative production processes, and an investigation of the feasibility of recycling some pollutants. (Rochester-IVI)
W86-00571

CHESAPEAKE BAY: SAVING A NATIONAL RESOURCE THROUGH MULTI-STATE COOPERATION,
Bureau of National Affairs, Inc., Washington, DC.
Dept. of Environment, Safety and Health Services.
M. A. Hutter.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 185-207, 1985. 167 Ref.

Descriptors: *Chesapeake Bay, *Resources management, Governmental interrelations, Water pollution control, Environmental policy, Aquatic plants, Bays, Water pollution sources.

The value of the Chesapeake Bay as a natural resource, its decline as the result of pollution and other problems, and federal and state efforts to restore the Bay, from the December 1983 Chesapeake Bay Conference to the present, are reviewed. The Chesapeake Bay has more than 2,500 sq mi of surface area and about 8,000 miles of shoreline; it supports extensive recreation, port, and industrial activities. A 5-yr Environmental Protection Agency (EPA) study of the Bay's deterioration focused on three problems: loss of submerged aquatic vegetation, increases in concentrations of toxic chemicals, and nutrient enrichment. Four major phenomena were identified in 1982 and 1983 as contributing to the Bay's decline: population growth, increased urbanization, intensified agricultural activity, and wetlands loss. The Chesapeake Bay agreement of 1983, involving state Governors, the Mayor of Washington, District of Columbia (DC), and the EPA Regional Administrator, mandated twice yearly review of progress of Bay programs and annual reports on progress in implementation. Federal initiatives have been taken through EPA under the Clean Water Act. Other departments of the federal government have entered into joint resolutions with EPA agreeing to protect and enhance the condition of the Bay. In addition, state initiatives by Maryland, Virginia, Pennsylvania, the District of Columbia, and cooperative agreements, such as the Chesapeake Bay Commission, address specific problems created by each region's particular effect on the Bay. The key to the Chesapeake Bay Program's success so far has been cooperation and coordination among the federal and state agencies. It could take years, if not decades, however, for major programs established over the past year to become effective. The project is long-term and ongoing; reassessment of Bay programs in light of preliminary results will be necessary to keep restoration efforts oriented toward established goals. (Rochester-IVI)
W86-00572

PROBLEM OF PEOPLE: CRITICAL AREAS AND FLOATING ZONES IN THE CHESAPEAKE,

Briscoe, Kenney, Kaminetz and Lacer, Lexington Park, MD.
J. A. Kenney, III.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 209-218, 1985. 38 Ref.

Descriptors: *Chesapeake Bay, *Land use, *Floating zones, *Critical areas, Maryland, Zoning, Wildlife, Habitats, Recreation, Resources development.

Maryland's Chesapeake Bay Critical Area Act authorizes local jurisdictions to develop and implement programs to control the use and development of sensitive shoreline areas, designated by the act as 'Critical Areas.' The traditional approach to zoning involves a constant war for land use flexibility. The 'floating zone' concept was developed to permit certain land uses in accordance with an overall development plan for a designated area of land, without requiring a legislative determination of 'change or mistake' at the time of a comprehensive rezoning. A floating zone is a specialized use district created by ordinance that 'floats' over an entire jurisdiction until it attaches to a specific property upon the petition of the property owner. A site plan, which typically includes restrictions on maximum building area, minimum green area, and, in some cases, requires off-site improvements, must be approved by the local governing body. Plan approval can be revoked if the plan's provisions, including restrictions, are not complied with, or if there is no meaningful development within a reasonable period of time. In one case, a 200-acre development on the Patuxent River was approved under a floating zone. The project included a central marina, habitat preservation areas, community beach areas with restricted access areas, and central sewage; the density was increased from 1.0 units per acre to 2.83 units per acre as a result of rezoning. Numerous conditions were imposed, covering such areas as street design, parking, sediment and stormwater control, and limitations on pleasure boat mooring and use. The cost of development in this instance were borne by the private sector, and the costs of maintaining wildlife habitats were borne by the people with access to them. The floating zone and planned unit development concept can be an effect means to meet increasing development pressure in a creative, positive way. (Rochester-IVI)
W86-00573

INTERAGENCY DISPUTES OVER DRY FIELDS OR CLEAN WATER: A CASE STUDY OF THE CONFLICT BETWEEN AGRICULTURAL DRAINAGE PROGRAMS AND THE CHESAPEAKE BAY CLEANUP,
Arnold and Porter, Washington, DC.
For primary bibliographic entry see Field 6G.
W86-00574

POINT SOURCE WATER QUALITY CONTROL IN VIRGINIA: CHOICES FOR THE CHESAPEAKE,
Chesapeake Bay Foundation, Inc., Richmond, VA.
For primary bibliographic entry see Field 5G.
W86-00575

MAJOR ENVIRONMENTAL STATUTES AFFECTING THE JAMES RIVER,
Thomas and Fiske, Richmond, VA.
T. G. Hayes.
Virginia Journal of Science, Vol. 36, No. 1, p 37-44, Spring, 1985.

Descriptors: *Legislation, *James River, *Virginia, *Environmental effects, Policy, Regulations, Water pollution control.

The most important of the numerous federal and state laws enacted that directly or indirectly control the impacts of human activity on our waterways are reviewed and, in some cases, related to the James River. Laws discussed include the National Environment Policy Act of 1969, the Clean Water Act, the State Water Control Law (Virginia), the Rivers and Harbors Appropriation Act of 1899, Marine Resources Commission Permits, Resource Conervation and Recovery Act, State Solid Waste Management, Toxic Substances Control Act, Federal Environmental Pesticide Control Act, Ports and Waterways Safety Act, Atomic Energy Act, and the Comprehensive Environmental Response, Compensation and Liability Act of 1980. (Baker-IVI)
W86-00586

6G. Ecologic Impact Of Water Development

ASSESSMENT OF ENVIRONMENTAL CONSIDERATIONS IN THE DESIGN AND CONSTRUCTION OF WATERWAY PROJECTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
F. D. Shields, and M. R. Palermo.
Technical Report E-82-8, September 1982. Final Report. 214 p, 71 Fig, 5 Tab, 156 Ref, Append.

Descriptors: *Environmental effects, *Waterways, *Construction, *Channel improvement, *Flood control, *Water quality, *Aquatic habitats, Levees, Dikes, Navigation, Bank protection, Protection, Stream stabilization, Stream banks, Transportation, Aquatic animals, Meanders, Habitats, Species diversity, Vegetation, Riparian vegetation, Land use, Aesthetics, Recreation, Wolf River.

Factors and constraints in design and construction of waterways projects affecting environmental quality are identified. Included are channel modifications for flood control and navigation, dikes, streambank protection, and levees. Adverse environmental impacts of flood control channel modification include a variable degree of loss of valuable habitats and habitat diversity, channel instability, reduction of aesthetic value, water quality degradation, and undesirable hydrologic changes. Methods to reduce adverse impacts are stream restoration, artificial instream structures, modified channel cross sections, and management of cutoff meanders. Navigation channel modifications produce losses in backwater habitat. Dike construction reduces water surface area and habitat diversity due to sediment accretion in the dike field. Notches or gaps in the dikes can slow the rate of sediment accretion. Bank protection causes loss of riparian vegetation and reduces the rate of channel migration. Some bank protection devices are vegetation and combinations of structure and vegetation. Levees create drier conditions on the landside of the levee and resulting land use changes. Vegetation on levees can be managed to preserve or improve wildlife habitats, aesthetics, and recreational features.
W86-00315

BENTHIC MACROINVERTEBRATES OF SELECTED AQUATIC HABITATS OF THE LOWER MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W86-00324

INSTRUCTION REPORT ON FRESHWATER MUSSELS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W86-00325

USER'S MANUAL FOR THE EVALUATION AND SENSITIVITY ANALYSIS PROGRAM (ESAP),
Colorado Univ. at Boulder. Center for Research on Judgment and Policy.
J. Mumpower, and L. Bollacker.
Technical Report E-81-4, March 1981. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 279 p, 131 Fig, 3 Tab, 4 Append.

Descriptors: *Planning, *Environmental policy, *Water resources development, *Water management, *Sensitivity analysis, *Evaluation, Environmental effects Alternative planning.

The Evaluation and Sensitivity Analysis (ESAP) is an environmental planning tech the evaluation of alternative water reso agement plans. ESAP is based on a w scaling approach to impact assessment an tive evaluation. The evaluation of the d or acceptability of an alternative is ba systematic combination of information impacts on the natural and cultural reso information about the importance (we preferred levels of such resources. Inform a number of individuals or groups is used mine how sensitive their evaluations are ences in judgments about the importance ferred levels of resources or to uncertain jections of resource impacts. The ana formed by ESAP provides the user with types of information: (a) an evaluation of natives for each individual or group c and (b) an analysis of how the indiv groups differ in their evaluation of alt The analysis requires the user to provide chial description of the evaluation proble includes the variables or resources affect alternatives, projected levels of the va resources for each of the alternatives, and tion about the weights or importance v the variables for each of the groups und eration. If the user wishes to examine the uncertainty on evaluation, data describi tainty must also be input into the (Author)
W86-00328

REPORT OF FRESHWATER MO WORKSHOP, MAY 19-20, 1981.
Army Engineer Waterways Experimen Vicksburg, MS.
Vicksburg, MS. Final Report, May 1982 C. Miller, compiler. 192 p.

Descriptors: *Environmental effects, *Mollusks, *Aquatic habitats, *Shellfish my, Endangered species, Higgin's ey Mussels, Aquatic animals, Sampling, Lampsilis higginsi, Mississippi River.

A workshop on freshwater mollusks add following subjects: (1) taxonomy and e freshwater mussels, (2) appropriate sampl odologies for mollusks, (3) methods to cr tat and/or relocate mollusks, (4) informa able from commercial shell harvesters present and past concerns about endang cies. Although much of the data conc Upper Mississippi River and the Tenn Alabama river systems, the informatio applied to all freshwater mollusks reg location. The Endangered Species Act gram were described. Applying the taxon ecological principles of immature biomes in northern North America) to mature b found in the southeastern U.S.) are shov ums are a valuable resource in identif mollusks; 25 museums are listed for refe sampling techniques available, diving is deep water sampling, and hand-picking shallow water. Brailing is effective fo surveys in large rivers. Mechanical dredg be avoided. Other mollusk studies des the distribution of Mobile Basin unionid the Cumberlandian mollusk conservation relocation of an endangered species (Hi pearly mussel), the role of the U.S. Ar neers in mollusk studies, and commercial mollusks.
W86-00329

OVERVIEW OF THE TENNESSEE-T BEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobil
For primary bibliographic entry see Field
W86-00332

MAJOR PROJECT IN THE AGE OF VIRONMENT: OUT OF CONTR COMPLEXITY, AND CHALLENGE,
Corps of Engineers, Mobile, AL. Mobil
For primary bibliographic entry see Field

-00333

ROLOGY, HYDRAULIC, AND SEDIMENT SIDERATIONS OF THE TENNESSEE-IBIGBEE WATERWAY,
s of Engineers, Mobile, AL. Mobile District.
. Underwood, and F. D. Imsand.
ronmental Geology and Water Science, Vol. . 1/2, p 69-90, 1985. 14 Fig, 10 Tab, 53 Ref.

riptors: *Tennessee-Tombigbee Waterway, struction, *Sedimentation, *Hydrology, Engi-ng, Water resources development, Hydraulic eering, Design criteria, Monitoring.

ydrology and hydraulic aspects of the Ten-e-Tombigbee Waterway system are described with the hydraulic design of the hydraulic es, followed by a discussion of sedimentation cteristics of the waterway. A brief discussion ered of the monitoring programs for the hy-gical and sedimentological aspects of the ct. Ten locks and dams were constructed that lakes with a total water surface area of over acres. The overall length of the waterway is iles and required the excavation and disposal er 307 million cu yd of material. Specific considered include climate, hydrology, sec-f the waterway (river sections, canal section, vide section), design and construction of the tion channels, locks and dams and spillways, entation, and project monitoring (river stage ream gauging, and rainfall stations). (Baker-

0336

TIVE SPOIL: DESIGN CONCEPTS, CON-CTION TECHNIQUES, AND DISPOSAL CAVATED MATERIALS,
ana State Univ., Baton Rouge. School of onmental Design.
imary bibliographic entry see Field 8A.
0337

MARY OF ENVIRONMENTAL ISSUES FINDINGS: TENNESSEE-TOMBIGBEE RWAY,
of Engineers, Mobile, AL. Mobile District.
McClure, IV.
nmental Geology and Water Science, Vol. 1/2, p 109-124, 1985. 5 Fig, 1 Tab, 20 Ref.

ptors: *Tennessee-Tombigbee Waterway, ruction, *Environmental effects, Decision , Planning, Water resources development.

nactment of the National Environmental Act (NEPA) had a substantial influence on nner in which the Tennessee-Tombigbee vay (Tenn-Tom) was constructed. The ciplinary approach including a board of consultants functioning as environmental s, played a valuable role toward meeting ectives of minimizing adverse impacts and zing the positive environmental aspects. Im-f the Tenn-Tom addressed include aquifer wn, waterlogging, water quality, interbasin , mixing of species, endangered species, sedimentation, and loss of wildlife habitat. dings are discussed, and the identified im-laced into perspective. While implementa-the Tenn-Tom waterway involved losses ource tradeoffs, measures have been incor-into the project to mitigate for significant e losses. The evaluation, planning, and process for the Tenn-Tom can serve as approach for compliance with NEPA and vironmental statutes. (Baker-IVI)
338

TIC HABITAT STUDIES ON THE R MISSISSIPPI RIVER, RIVER MILE REPORT 2, AQUATIC HABITAT MAP-

Engineer Waterways Experiment Station, rg, MS. Environmental Lab.
bb, and J. R. Clark.
neous Paper E-80-1, U.S. Army Environ-and Water Quality Operational Studies, March 1981. 24 p, 4 Fig, 1 Tab, 3 Plates.

Descriptors: *Aquatic habitats, *Aquatic environment, *Aquatic life, Mapping, Impact, *Flow rates, *Lower Mississippi River, Channels, Banks, Sandbars, Dike fields, Floodplains, Borrow pits, Maps.

To provide data for design of field studies to determine the impacts and ecological value of the man-made habitats formed by dike and revetment structures in the Lower Mississippi River, the aquatic habitat of a 50-mile reach of the river (mile 480-530 Above Head of Passes, AHP) was quantitatively mapped to determine spatial relationships among and within habitat types as a function of river and discharge. Twelve aquatic habitat types were defined within the study reach based on hydraulic, geomorphological, and ecological criteria: main channel, natural banks, revetted banks, sandbars, dike fields, permanent and temporary secondary channels, abandoned river channels (Types I and II), oxbow lakes, borrow pits, and inundated floodplain. By use of controlled aerial photography and hydrographic survey data, aquatic habitat surface acreages were computed for three river stages (low flow=+13.2 ft, medium flow=+24.6, and high flow=+38.4 ft on the Greenville, MS gage). Results of the habitat mapping revealed a significant change in total aquatic habitat acreage with changes in river stage and discharge. At the low flow stage 18,581 acres of habitat were present. Habitat area increased to 29,020 acres at medium flow and rose to 56,902 acres for high flow, a total increase of 222% in area over low flow conditions. The main channel was the predominant habitat type during the low flow period, composing 45% of total habitat. Dike fields and the main channel were the most abundant habitat types at medium flow, making up 28 and 29% of total habitat, respectively. For the high flow period, inundated floodplain habitats were the most common habitats, comprising 27% of the total aquatic habitat. Variation in river stage and discharge caused a significant change in the spatial relationships.
W86-00373

STABILITY OF ARTIFICIALLY-DRAINED LOWLANDS: A THEORETICAL ASSESSMENT,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
J. D. Phillips.
Ecological Modelling, Vol. 27, No. 1/2, p 69-79, March, 1985. 2 Fig, 1 Tab, 31 Ref.

Descriptors: *Model studies, *Drainage systems, *Artificial watercourses, *Wetlands, *North Carolina, Stability, Lowlands, Water resources development, Environmental effects.

The impacts of artificial land drainage on wetlands was investigated, using coastal plain lowlands of North Carolina as an example, from a holistic viewpoint. The rate of drainage channel degradation following construction of artificial drainage networks appears to be the key variable determining stability of surface hydrologic systems. If degradation is rapid, the system is metastable and a new equilibrium may be achieved within a few years, though a return to the pre-alteration state is unlikely. Limited data available in the North Carolina coastal plain indicate that artificially-drained lowland hydrologic systems are metastable. Ditch and canal degradation is rapid after initial disturbance, but unmaintained channels do persist. More data are needed, however, on rates and processes of drainageway degradation and on the persistence of manmade stream networks. It appears that regular dredging, re-excavation, snagging, and vegetation removal in ditch-and-canal systems in North Carolina is limiting the ability of natural systems to adjust to perturbations and is maintaining the hydrologic system and, by extension, the ecosystem, in an unstable state. (Baker-IVI)
W86-00434

CONCORDANT VARIATION IN THERMAL TOLERANCE AND ALLOZYMES OF THE RED SHINER, NOTROPIS LUTRENSIS, INHABITATING TAILWATER SECTIONS OF THE BRAZOS RIVER, TEXAS,
North Texas State Univ., Denton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W86-00452

PROBLEM OF SARDINE FISHERIES IN EGYPT,
Institute of Oceanography and Fisheries, Alexandria (Egypt).
For primary bibliographic entry see Field 5C.
W86-00525

ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT OF THE JONGLEI CANAL PROJECT, SOUTHERN SUDAN,
Khartoum Univ. (Sudan). Inst. of Environmental Studies.
A. I. Moghraby, and M. O. Sammani.
Environmental Conservation, Vol. 12, No. 1, p 41-48, 1985. 2 Fig, 64 Ref.

Descriptors: *Environmental effects, *Social aspects, *Economic aspects, *Jonglei Canal, *Sudan, Cost-benefit analysis, Ecological effects.

The environmental and socio-economic impacts, as presently understood, of the Jonglei Canal project, southern Sudan, are reviewed, and it is concluded that completion of the project is justified both in terms of short- and long-term cost/benefit perspectives. Plankton and limnology, aquatic macrophytes, benthos and insect fauna, fish and fisheries, geography and geology, and wildlife are reviewed, and the socio-economic background of the 'Sudd' area is reviewed. Claims made for and against the building of the canal are reviewed, and possible changes in water quality, fisheries, and large wildlife are discussed. If the Jonglei Canal project is completed as planned, a new mode of life for both man and domestic and wild animals is anticipated. This new mode of life will be more satisfactory than the today's situation, which is already changing as the result of other causes unrelated to the canal project. (Rochester-IVI)
W86-00557

EFFECTS OF HUMAN ACTIVITIES ON ZAMBIA'S KAFUE FLATS ECOSYSTEMS,
Akron Univ., OH.
W. A. Sheppe.
Environmental Conservation, Vol. 12, No. 1, p 49-57, 1985. 8 Fig, 29 Ref.

Descriptors: *Environmental effects, *Kafue Flats, *Zambia, Dam effects, Flooding, Wildlife, Habitats, Vegetation, Aquatic plants, Water management.

The Kafue Flats, a 6,000 sq km floodplain area of the Kafue River, Zambia, has been affected by construction of two hydroelectric dams, one above the Flats at Itezhitezhi and another downstream from the Flats in the upper Kafue River Gorge. The Flats was studied for 12 mo in 1967-68, was visited in 1970 and 1971, and was studied for 6 wk in May-June 1983. In 1967, periodic flooding contributed to the support of a dense growth of emergent grasses across much of the area. Large herds of lechwe (Kobus leche), smaller numbers of zebra (Equus burchelli), wildebeest (Connochaetes taurinus), and other ungulates fed on the high ground, while one of the world's greatest agglomerations of avian biomass occupied the floodwaters and shoreline. At the same place in May 1983, the lower elevations on the floodplain were covered by permanent open water, and the higher elevations were perhaps permanently dry. The very productive vegetation had been largely replaced by aquatic plants in the open water, whereas the dry former floodplain had a sparse cover of low grasses and was being invaded by woody plants. There were few birds, relatively few lechwe, and no other large ungulates. Numerous less conspicuous changes had occurred in the vegetation, insect, bird, and small mammal populations. The effect of the dams was obscured by the effects of drought, hunting, and human use of the area. The long-term effects of the dams on the Kafue Flats are not now clear. Scheduled water releases or diking schemes

to control water in certain areas are alternatives that could help preserve wildlife habitat on the floodplain, but they conflict with maximum power generation, which is the current top priority for this system. (Rochester-IVI)
W86-00558

PROBLEM OF PEOPLE: CRITICAL AREAS AND FLOATING ZONES IN THE CHESAPEAKE,
Briscoe, Kenney, Kaminetz and Lacer, Lexington Park, MD.
For primary bibliographic entry see Field 6E.
W86-00573

INTERAGENCY DISPUTES OVER DRY FIELDS OR CLEAN WATER: A CASE STUDY OF THE CONFLICT BETWEEN AGRICULTURAL DRAINAGE PROGRAMS AND THE CHESAPEAKE BAY CLEANUP,
Arnold and Porter, Washington, DC.
T. J. Lindon, and M. P. Gergen.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 219-262, 1985. 241 Ref.

Descriptors: *Drainage effects, *Chesapeake Bay, *Water quality control, *Environmental effects, Upper Chester River Project, Maryland, Aquatic plants, Nutrients, Channeling.

The Environmental Protection Agency (EPA) study of the Chesapeake Bay has documented and substantial contribution made by agriculture to the deterioration of water quality of the Bay in terms of increased levels of nutrients in the water, decreases in numbers of submerged aquatic plants, and destruction of wetlands and associated vegetation. The Soil Conservations Service's (SCS) proposed Upper Chester River (Maryland) Project proposes to channelize streams to improve drainage on 9,400 acres of currently wet cropland and 5,200 acres of interdependent non-wet cropland. SCS did not adequately consider the adverse environmental consequences of this project in its Environmental Impact Statement (EIS), nor has it heeded or explored warnings of other government agencies with environmental expertise. These agencies lack effective mechanisms for forcing SCS to respond to their environmental concerns. In light of the Upper Chester River example, new approaches seem appropriate in three areas: (1) consideration of alternatives to channelization projects, since their negative environmental consequences are becoming more and more evident, (2) more attention by SCS to the concerns of other government agencies with more environmental expertise; this could be done in the forthcoming Supplemental EIS, and (3) the use by EPA of its as yet untested preemptory authority under section 404(c) of the Federal Water Pollution Control Act, which would allow it to prohibit, prospectively, the discharge of dredged or fill material at a particular site. (Rochester-IVI)
W86-00574

ECOLOGICAL ALTERATIONS OF IOWA PRAIRIE-AGRICULTURAL STREAMS,
Iowa State Univ., Ames. Dept. of Animal Ecology.
B. W. Menzel, J. B. Barnum, and L. M. Antosch.
Iowa State Journal of Research, Vol. 59, No. 1, p 5-30, August, 1984. 2 Fig, 10 Tab, 38 Ref. EPA grant R807122.

Descriptors: *Iowa, *Land use, *Streams, *Ecological effects, *Agriculture, Prairies, Sediments, Water quality, Habitats, Invertebrates, Fish, Nutrients, Channelization.

Water quality, habitat structure, and macroinvertebrate and fish communities were surveyed in 1979-1980 in ten headwater streams of the Cedar River basin. All streams are affected by moderate to intensive agricultural land use in their watersheds, and the purpose of the study was to describe stream ecological changes caused by this influence. Most streams carried heavy sediment and nutrient loads, had fine-particulate substrates, were extensively channelized, had a wide range in daily flows, and were largely devoid of instream vegetation. Water quality was highest and habitat structure was most complex in a woodland stream, and a pattern of environmental differences was measured among the nine prairie streams. Invertebrate communities were dominated by the collector-scraper functional assemblage. Shredders were primarily represented by amphipods, isopods, and crayfish. Ten fish species, mainly minnows, were identified as fish community dominants in all streams. Eight environmentally sensitive species were absent or present in only small numbers. The streams were classified into four groups on the basis of 12 biotic and abiotic characteristics which serve to provide a composite measure of ecological change from presumptive natural conditions. (Author's abstract)
W86-00581

ISSUES IN THE JAMES RIVER CORRIDOR,
Richmond Regional Planning District Commission, VA.
D. Arkin.
Virginia Journal of Science, Vol. 36, No. 1, p 7-13, 1985.

Descriptors: *Resources management, *James River, Virginia, Land use, Water supply, Water demand, Transportation, Urban areas, Recreation, Industries, Wastewater treatment, Environmental effects.

The role of the James River in the lives of the people living near it is large, including its use for water, transportation, recreation, industry, wastewater treatment, and a natural environment. The projected addition of more than 100,000 people to the Richmond Region by the year 2000 raises several issues affecting the river, including: water supply for power generation, human consumption, and industry, which is both a public health and economic issue, preservation of historic places and scenic areas associated with the James River, development of recreation and tourism, accomodation of growth pressures from residential, commercial, and industrial development, which requires control of land use, protection of the agricultural potential of the Richmond Region, and transportation problems associated with river use, access to the river, and the river as a barrier. A goal relating to these issues should be to determine 'reasonable and appropriate' uses of land in the James River corridor that meet the needs of the community and are compatible with what the land can best support. (Rochester-IVI)
W86-00582

HUMAN ECOLOGY OF THE JAMES RIVER,
Richmond Univ., VA. Dept. of Biology.
For primary bibliographic entry see Field 4C.
W86-00583

MODIFICATION OF THE JAMES RIVER,
Corps of Engineers, Norfolk, VA. Norfolk District.
F. T. Wootton, Jr.
Virginia Journal of Science, Vol. 36, No. 1, p 19-25, Spring, 1985. 7 Fig.

Descriptors: *James River, *Kepone, *Dredging, *Turbidity, Suspended solids, Environmental effects, Water resources development.

The James River Basin is 225 miles long, averaging 40 to 50 miles in width. The navigation portion of the James River is located at and downstream from Richmond. The Federal navigation project, authorized in 1870, is maintained so as to provide a channel 25 feet deep and 200 to 300 feet wide from Hampton Roads upstream to the Deepwater Terminal at Richmond. For a maintenance dredging project, a hydraulic pipeline cutterhead dredge was converted by fitting it with a dustpan head and ladder, to test the efficiency, output and environmental impacts while dredging in the James River. An environmental monitoring program was in place during the dredging tests, concentrating mainly on Kepone and turbidity. Material was deposited in the open water areas about 1,000 feet from the channel. Neither turbidity nor kepone levels increased significantly above background in the water column around the dredge [illegible] either the dustpan or the cutter mode of [illegible] operation. The situation differed at the [illegible] area. While the turbidity and suspended [illegible] this area were similar, but slightly highe[illegible] the cutter mode, the dissolved kepone le[illegible] the cutterhead averaged more than three t[illegible] levels during the dustpan mode. This ma[illegible] plained by the fact that the cutterhead [illegible] more than five times the amount of materia[illegible] by the dustpan, during more or less equal[illegible] on the calendar. Overboard disposal prov[illegible] economical and without serious environm[illegible] fects. (Baker-IVI)
W86-00584

JAMES RIVER FISHERIES AND TH[illegible] EFFECTS,
Richmond Univ., VA.
W. S. Woolcott.
Virginia Journal of Science, Vol. 36, No. [illegible] 29, Spring, 1985. 6 Ref.

Descriptors: *Fisheries, *Environmental [illegible] *Thermal pollution, *James River, *[illegible] *Powerplants, Water resources developm[illegible] clear powerplants, Fish, Heated water, W[illegible] lution effects.

Fishes represent the top trophic level in t[illegible] River, Virginia as they usually do in othe[illegible] habitats. Since the 1950's literally hundred[illegible] ies of the effects of temperature on fis[illegible] been made. Three electric power stations[illegible] cussed, Bremo Power Station, Chesterfiel[illegible] Station and Surry Power Station, which [illegible] approximately one third of Vepco's to[illegible] electric power output. The immediate i[illegible] their heated effluents on fisheries in th[illegible] River is minimal and restricted to the near[illegible] ity of the power station. Bremo Power[illegible] impacts on the Piedmont part of the Jam[illegible] impact is confined mainly to the first km b[illegible] outfall. Only occasionally were plume [illegible] tures as far as 8 km downstream conside[illegible] enough to have a significant effect on fish[illegible] terfield Power Station is located near th[illegible] reaches of the tidal James, in the middl[illegible] spawning area of several anadromous [illegible] Even so, the effect of this plant seems ve[illegible] Surry Power Station, the only nuclea[illegible] James River power station, is the only on[illegible] cally designed from day one to reduce it[illegible] on the environment. Several features of th[illegible] have been responsible for the greatly [illegible] impact it might have otherwise had on the [illegible] ment. When results of the environmenta[illegible] studies of the three James River power sta[illegible] compared it appears that they have in co[illegible] negligible, short term detrimental effect o[illegible] ies. (Baker-IVI)
W86-00585

PECULIAR STRUCTURE OF THE T[illegible] MIA NATURAL FOCUS IN THE DON[illegible] DELTA WITH SPECIAL REFERENCE [illegible] ONOMICAL INFLUENCE (SOVREME[illegible] STRUKTURA PRIRODHOGO OCHA[illegible] LYAREMII DEL'TY DONA V SVYAZI [illegible] ZYAISTVENNYM VOZDEISTVIEM),
Nauchno-Issledovatel'skii Protivochumny[illegible] Rostov-na-Donu (USSR).
M. G. Protopopyan, V. G. Nalyotov, G. M[illegible] Medinskii, M. Ya. Semyonov, and A. E. Z[illegible]
Zoologichesky Zhurnal, Vol. 64, No. 3, p [illegible] March, 1985. 1 Tab, 7 Ref.

Descriptors: *Public health, *Tularemia, *[illegible] *Don River Delta, *USSR, River flow, Fis[illegible] Drainage effects, Environmental effects, [illegible] tics.

Thirty years of economical usage of the D[illegible] delta did not result in elimination of the tu[illegible] epizootia. Anthropogenic factors (control[illegible] flow, construction of fish farms, high road[illegible] ration and drainage) ensured the formatio[illegible] culiar, not characteristic of the classical fo[illegible] type, faunistic complexes of rodents and

ocus spatial and biocoenotic structure. (Au-
abstract)
00593

ESOURCES DATA

Data Acquisition

TOGRAMMETRIC TECHNIQUES FOR ITORING SOIL EROSION,
ia Univ., Athens. Dept. of Geography.
imary bibliographic entry see Field 2J.
0342

NDWATER MONITORING AND LE BIAS,
oo Univ. (Ontario). Dept. of Earth Sciences.
Gillham, M. J. L. Robin, J. F. Barker, and J.
rry.
can Petroleum Institute, Washington, DC.,
983, 206 p. 40 Fig, 14 Tab, 120 Ref.

ptors: *Monitoring, *On-site data collec-
*Sampling, *Water sampling, *Reviews,
quality, *Groundwater pollution, Data in-
ation, Data aquisition, Data collections,
dwater, Water properties, Chemical proper-
ysical properties.

ctors which can lead to uncertainty in water quality data are systematically re-. Hydrogeologic factors which may cause uncertainty are variations in regional flow eristics, in physical and chemical controls aminant migration, and in porosity of media draulic conductivity. Sample integrity can a potential source of bias in the evaluation ndwater quality. Processes which may loss in sample integrity include contamina-the geologic materials in the vicinity of the one of the sampling installation by drilling, nation from the instillation equipment or g materials, and contamination by sample g and volatilization or atmospheric sub-. Human error may also affect sample integ-ne geochemical characteristics of several water contamination parameters (pH, spe-nductance, total organic carbon and total halogen) and the particular sampling pre-that are required for each are discussed. ar consideration is given to the 29 param-ted in the Resource Conservation and Re-Act of the U. S. Environmental Protection . In addition, four specific gasoline compo-re examined. Sampling objectives, data ment and tests of difference, and sampling saturated zone are also discussed.
345

PORT, FATE AND EFFECTS OF Y-RELATED POLLUTANTS: EVALUA-OF SURFACE AND GROUNDWATERS; DIX 1: PRELIMINARY LISTING OF IVE SURFACE WATERS,
ven National Lab., Upton, NY. Dept. of nd Environment.
ary bibliographic entry see Field 5B.
48

CTERIZATION OF BENTHIC MICRO-T; AN EXPERIMENTAL SYSTEM FOR IC INSECTS,
Univ. at Urbana-Champaign. Dept. of d Regional Planning.
ary bibliographic entry see Field 2H.
43

AND INSTALLATION OF LARGE NG LYSIMETERS,
ural Research Service, Bushland, TX.
ation and Production Lab.
nary bibliographic entry see Field 2D.
89

ATION OF A CLASS A EVAPORA-AN,

Agricultural Research Service, Mississippi State, MS. Crop Simulation Research Unit.
For primary bibliographic entry see Field 2D.
W86-00499

DROP SIZE DISTRIBUTION MEASUREMENT PROBLEMS USING A LASER UNIT,
South Dakota State Univ., Brookings. Dept. of Plant Science.
R. A. Kohl, R. D. von Bernuth, and G. Huebner.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 190-192, January/February, 1985. 4 Fig, 3 Ref.

Descriptors: *Lasers, *Measuring instruments, *Drop size, Sprinklers, Rain, Fluid drops,.

A He-Ne laser raindrop measurement unit was compared to the flour method for measuring raindrop size distributions from an agricultural sprinkler (spray type, 9.5 mm nozzle). The laser unit recorded fewer small droplets and more large drops compared to the flour method. Drops larger than the largest stable drop size were recorded by the laser system, even into the 8, 9, and 10 mm size classes. Recording of such drops resulted from two or more drops falling through the laser sensing area, one behind the other, in the 500 mm depth of field and somewhat offset. The result was coincidence error; recording of two or more drops as one larger drop. The probability of coincidence is very low (0.09% for a 2.5 mm drop at 50 mm/hr intensity) for a natural rain, but it increases to 5.3% for a 1.25 mm drop event at 500 mm/hr as occurs with an agricultural sprinkler. If 5.3% of the drops are incorrectly measured as twice as large as they really are, a volume error of 37% results. Several techniques were tried to remove the coincidence error from data, but without success. The laser system is therefore recommended for rainfall, but not for use with agricultural sprinklers. (Rochester-IVI)
W86-00502

USE OF DIALYSIS CELLS FOR INVESTIGATING PORE WATER COMPOSITION IN WETLAND SUBSTRATA, WITH PARTICULAR REFERENCE TO DISSOLVED IRON AND SULPHIDE,
Sheffield Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W86-00511

LANDSAT STUDY OF THE AQUATIC VEGETATION OF THE LAKE LUODONJARVI RESERVOIR, WESTERN FINLAND,
Oulu Univ. (Finland). Dept. of Astronomy.
For primary bibliographic entry see Field 2H.
W86-00532

RECORDING ECHO SOUNDER FOR ASSESSING SUBMERGED AQUATIC PLANT POPULATIONS IN SHALLOW LAKES,
Agricultural and Food Research Council, Oxford (England). Weed Research Organization.
C. J. Stent, and S. Hanley.
Aquatic Botany, Vol. 21, No. 4, p 377-394, April, 1985. 11 Fig, 2 Tab, 5 Ref.

Descriptors: *Aquatic plants, *Submerged plants, *Echo sounders, Remote sensing, Lakes, Water depth, Mapping.

This paper describes the design of a recording echo sounder which has a depth range of 6 m and can be used in shallow lakes and rivers to determine submerged plant heights and water depths. The instrument uses mainly digital techniques, has a liquid crystal display, and records echoes on standard audio cassettes. These are returned to the laboratory for analysis, using a microcomputer to produce various maps of the data. This system has been successfully used to map plant populations at several sites, the data for which are given. (Author's abstract)
W86-00533

8. ENGINEERING WORKS

8A. Structures

VALIDATION REPORT: COMPUTER PROGRAM FOR DESIGN AND ANALYSIS OF INVERTED-T RETAINING WALLS AND FLOODWALLS (TWDA),
Army Engineer Waterways Experiment Station, Vicksburg, MS. Automatic Data Processing Center.
W. A. Price, R. L. Hall, R. L. Mosher, C. C. Hamby, and R. Veselka.
Instruction Report K-81-3, February 1981. Final Report. 375 p.

Descriptors: *Structural engineering, *Soil mechanics, *Computer programs, *Design criteria, *Retaining walls, Walls, Load distribution, Stability analysis, Earth pressure, Soil pressure, Hydrostatic pressure, Seepage, Soil properties, Shear, Friction, Compressive strength, Earthquake engineering, Seismic properties, Water pressure, Reinforced concrete, Concrete, Stress, TWDA program.

Sample problems and their solutions verify the computer program TWDA (T-wall design/analysis), which is a user-oriented interactive, modular time-sharing program to aid in structural design and analysis of inverted-T retaining walls and floodwalls founded on earth or rock. The program has three major sections: executive command phase, stability modules (compute active earth pressures and determine overturning and sliding stability), and structural modules (perform stress analysis of the wall or design for minimum slab thickness). The program's goals are (1) a minimum-cost adequate design based on current codes and criteria, independent of the user's experience and (2) encouragement of personal judgment and imagination through interaction.
W86-00318

OVERVIEW OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
S. R. Green.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 9-13, 1985. 1 Tab.

Descriptors: *Tennessee-Tombigbee Waterway, *Water resources development, Mississippi, Alabama, Waterways, Construction, Lakes, Engineering, Navigation, Recreation.

When the Tennessee-Tombigbee Waterway of Mississippi and Alabama opened to commercial and recreational traffic on January 16, 1985, some 21 months ahead of schedule, it signaled the completion of the largest Army Corps of Engineers Civil Works project ever undertaken. The feasibility of the project was first studied by the Corps more than 110 years ago, but not reported as economically justified until 1938. Construction was authorized in 1946 by the River and Harbor Act which provided for a waterway connection between the inland navigation systems of the Tennessee, Ohio, and upper Mississippi Rivers, and the navigable Black Warrrier-Tombigbee River System which connects with the port of Mobile. The waterway is divided into three distinct sections depending on the means of construction. The utilization of different design and construction techniques was a balance of economics, construction capability, and environmental concern. The 10 lakes formed in the construction of the waterway impound 44,000 acres of water, used for recreation purposes as well as navigation. The benefits derived from the Tennessee-Tombigbee Waterway are virtually all transportation savings resulting from use of the waterway as opposed to alternate routes or modes of transportation. Recreation and fish and wildlife habitat enhancement amounted to only a few percentage points of the total benefits. (Baker-IVI)
W86-00332

Group 8A—Structures

CREATIVE SPOIL: DESIGN CONCEPTS, CONSTRUCTION TECHNIQUES, AND DISPOSAL OF EXCAVATED MATERIALS,
Louisiana State Univ., Baton Rouge. School of Environmental Design.
G. J. McLindon.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 91-108, 1985. 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Tennessee-Tombigbee Waterway, *Construction, *Design criteria, *Spoil disposal, Planning, Water resources development, Excavation, Environmental effects, Waterways.

Construction methods used in building the Tennessee-Tombigbee Waterway are reviewed including the disposal of surplus excavated materials and the reclamation of disposal areas along the waterway. Emphasis is placed on the steps taken to assure protection of natural resources and to promote overall enviromental quality. The overall design of the waterway and disposal of excavated materials was imaginative and positive, taking advantage of natural topography and utilizing techniques devised to overcome and accommodate the difficulties encountered. In keeping with the objective of locating disposal units in the least sensitive areas, three disposal sites utilized abandoned gravel pits, two sites being completely contained within the mined out area, the third partially contained. The vast majority of areas had no predetermined development use and, being in the floodplain, were designated as prime wildlife habitat locations. Investigation of several completed disposal areas indicate that natural revegetation is occurring at a satisfactory rate and that the natural flora contains an abundance of wildlife food plants. The disposal of hydraulically dredged material along the river section of the Tenn-Tom Waterway could have created massive long range environmental impacts. From the outset a positive attitude directed the methods of disposal into creative ventures. (Baker-IVI)
W86-00337

SELF-CLEANING, NON-POWERED TRASH SCREENS FOR SMALL IRRIGATION FLOWS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 4A.
W86-00490

8B. Hydraulics

BANK PROTECTION TECHNIQUES USING SPUR DIKES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Copeland.
Miscellaneous Paper HL-83-1, January 1983. Final Report. 32 p, 22 Fig, 2 Tab, 24 Ref.

Descriptors: *Hydraulics, *Erosion control, *Bank protection, *Dikes, Scour, Protection, Channel erosion, Stream banks, Hydraulic models, Model studies.

The effects of impermeable spur dikes as a bank protection technique in a concave bend were studied with a hydraulic model. The tests were conducted to observe channel bed and bank response in a stream with noncohesive banks where suspended load is insignificant. The following conclusions were reached. Spacing-to-length ratios up to three may be effective in protecting concave banks with spur dikes; however, some bank protection may be needed. Spur dike roots should be protected from scour caused by vortices set up along the upstream and downstream faces. The spur dike should be aligned perpendicular to the bank or current. Aprons effectively limit the depth of scour at the dike's toe. The development of a scour hole at the dike toe may be slowed by the formation of an armor layer. Existing equations for scour prediction at spur dikes may not be applicable to dikes in concave bends.
W86-00311

PREVENTION OF SHOALING AT LITTLE LAKE HARBOR, MICHIGAN: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
W. C. Seabergh, and J. W. McCoy.
Technical Report HL-82-16, July 1982. Final Report. 373 p, 28 Fig, 8 Tab, 293 Plates, 13 Ref.

Descriptors: *Hydraulics, *Breakwaters, *Lakes, *Sedimentation, *Shore protection, Hydraulic models, Model studies, Shoals, Protection, Little Water Harbor, Michigan, Lake Superior, Channels, Boating, Navigation, Seiches.

A 1:75-scale hydraulic model was used to study the breakwater structures at Little Lake Harbor, Michigan, on the south shore of Lake Superior. Existing breakwaters have not prevented extensive shoaling in the entrance channel. It was determined that seiche oscillations with periods near the inlet-bay Helmholz period occurred frequently. These oscillations could generate velocities as high as 4.5 fps in the entrance channel, with a median velocity of 0.62 fps. Model tests indicated an optimum plan--a 570-ft long detached dogleg breakwater on the east side of the entrance. This structure would allow the gap between the new breakwater and the shore to close from sediment deposition. Adding a caisson at the lakeward terminus would not adversely impact shoaling patterns. This plan would also provide a straight-in approach for boat traffic and reduce seiche oscillations in the harbor and velocities in the entrance.
W86-00317

BOUNDARY-FITTED COORDINATE CODE FOR GENERAL TWO-DIMENSIONAL REGIONS WITH OBSTACLES AND BOUNDARY INSTRUSIONS,
Mississippi State Univ., Mississippi State. Dept. of Aerospace Engineering.
J. F. Thompson.
Technical Report E-83-8, March 1983. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 80 p, 20 Fig, 12 Ref.

Descriptors: *Computer models, *Computer programs, *Mathematical studies, Flow, Differential equations, Finite difference methods, Numerical analyses, Boundary processes.

A code (WESCOR) for the generation of boundary-fitted coordinate systems for general two-dimensional regions with boundaries of arbitrary shape and with internal obstacles and boundary intrusions, arbitrary in shape and number, is described and instructions for input and use are given. The coordinate system is generated from the numerical solution of a system of elliptic partial differential equations with provision for controlling the spacing of the coordinate lines in the field. The transformed (computational) region is rectangular with the obstacles and intrusions transformed to slits and/or slabs. A small code to distribute points on various fundamental curves with exponential concentration is also described. This procedure will be particularly useful where numerical models are used to analyze flow problems with complex boundary conditions. Typical examples are riverine analysis or the design and evaluation of selective withdrawal outlet works. (Author's abstract, modified)
W86-00323

DESIGN FOR FLOOD CONTROL, WAVE PROTECTION, AND PREVENTION OF SHOALING, ROGUE RIVER, OREGON: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Bottin.
Technical Report HL-82-18, August 1982. Final Report. 577 p, 6 Fig, 25 Tab, 424 Photos, 41 Plates, 21 Ref, Append.

Descriptors: *Hydraulics, *Shoals, *Jetties, *Sedimentation, *Shores, *Flood control, Hydraulic models, Model studies, Wave action, Rogue River, Oregon, Rivers, Dredging, Dikes, Harbors.

A 1:100-scale hydraulic model was used to i
gate the effects of proposed improvements
Rogue River, Oregon, harbor area with rea
shoaling, wave action, and riverflow conc
The proposed improvements included (1)
sions and/or modifications of the present jet
dredging of a new entrance channel south
existing one with an extension of the soutl
and construction of a new jetty, and (3) insta
of dikes extending into the channel from the
jetty both with and without a weir sectio
conveyance channel installed on the nort
and overbank. Several structures proved i
tive or caused new problems--a timber-pil
extending from the south jetty, rubble-
dikes, conveyance channel and weir sectio
some configurations of jetty extensions. A
involving a new harbor entrance south
existing river mouth would cause a natural b
ing condition where the sediment on the
shoreline moves around the new middle jet
toward the south shoreline. Wave heights
harbor would be less than 1 ft for this plan.
W86-00326

**HYDRAULIC MODEL STUDY OF C
CANYON DAM SPILLWAY AND STI
BASIN,**
Bureau of Reclamation, Denver, CO. Engi
and Research Center.
R. L. George.
Report No. GR-82-9, August 1982. 30 p, 25
Ref.

Descriptors: *Hydraulic models, Spillways,
ing basin, *Model studies, *Scour, Basins,
number, Riprap, Channel scour, Approach
nels, Choke Canyon Dam, Texas.

A 1:80 scale hydraulic model of the Choke C
Dam spillway and stilling basin was studie
dam will be 35 m high and have a crest le
5,640 m. The spillway chute is 112.2 m wi
has a Froude number of about 4.4 at the
basin entrance. The stilling basin was desig
criteria developed for low Froude number
A modified entrance channel was developed
model was tested. Stilling basin walls were
ened as a result of model studies. A 14-mete
having 32 m of riprap extended downstrea
the end sill was recommended. The design
well for all discharges and scour was limite
area downstream from the riprap.
W86-00382

**LAKE SHERBURNE DAM MODEL STUD
Bureau of Reclamation, Denver, CO. Engi
and Research Center.
B. W. Mefford.
Report No. GR-82-15, September 1983. 32
Fig, 5 Ref.

Descriptors: *Hydraulic models, *Flow cha
istics, *Spillway capacity, *Flow resistance,
tation, Spillways, Outlets, Tunnel hyd
Channel flow, Lake Sherburne Dam, Flow
tana.

Hydraulic model studies, on a 1:15 scale m
Lake Sherburne Dam, were conducted to e
flow conditions in the spillway and outlet
tower structure during the passage of th
(inflow design flood). Model tests on the e
structure revealed two areas where pressure
consistently negative, and a third area wher
mittent roller vortices occurred during subt
spillway flows. A crown flow constrictio
placed in each tunnel, downstream of th
pressure areas, in the hydraulic model. Th
strictions were designed in conjunction
downstream air venting. The shape and loca
these constrictions were changed several ti
determine the discharge capacity versus lo
upstream pressure recover. Nonsymmetric
flow constrictions provided sufficient back
sure to raise the consistently low-pressure a
acceptable levels during the design dis
Roller vortices occurred due to a 90 deg
edged flow boundary on each side of the

. Large radius fillets were placed in the 90
ers to eliminate the vortex action.
83

oil Mechanics

TION REPORT: COMPUTER PRO-
FOR DESIGN AND ANALYSIS OF IN-
-T RETAINING WALLS AND FLOOD-
(TWDA),
ngineer Waterways Experiment Station,
g, MS. Automatic Data Processing

ary bibliographic entry see Field 8A.
18

ERING THE DIVIDE CUT OF THE
SEE-TOMBIGBEE WATERWAY; A
CHALLENGE TO CONSTRUCTION,
gineer District, Nashville, TN.
nmons.
ental Geology and Water Science, Vol.
2, p 51-67, 1985. 10 Fig, 1 Tab, 21 Ref.

rs: *Tennessee-Tombigbee Waterway,
ction, *Divide Cut, *Dewatering, Exca-
Canals, Water resources development,
ater.

ruction of the Divide Cut of the Tennes-
igbee Waterway required excavation of
n 150 million cu yd of unconsolidated
clay. A project of this magnitude was
nted for the Corps of Engineers. The
n of the unconsolidated materials re-
lowering of the artesian groundwater by
e of over 50 feet in order to construct
tain safely and economically the side
the canal. The materials excavated were
d sand with thin layers of interbedded
ervals ranging from a few inches to 10
The artesian pressures were lowered to
l through the use of deep wells while the
interstitial water was removed to the
cessary for equipment excavation by
enches constructed ahead of mass exca-
merous piezometers were used to moni-
vering of the artesian groundwater pres-
e excavation progressed. The project has
ted that soil materials in areas of high
ads can be safely excavated by lowering
n pressures with deep wells and can be
unwatered with trenches so rubber-
ment can be used for excavation. Large-
testing proved to be of extreme value in
appropriate construction techniques
sidered to be a necessary component in
successfully produce a design for any
his magnitude. (Baker-IVI)

MODIFIED SOIL IN CANAL

Reclamation, Denver, CO. Engineering
ch Center.
y bibliographic entry see Field 8F.

k Mechanics and
gy

EOLOGICAL AND GEOTECHNICAL
OF THE TENNESSEE-TOMBIGBEE
AY,
ngineers, Mobile, AL. Mobile District.

ntal Geology and Water Science, Vol.
p 25-50, 1985. 17 Fig, 3 Tab, 10 Ref.

: *Water resources development, *Ten-
bigbee Waterway, *Hydrogeology,
g geology, Canals, Waterways, Con-
Environmental effects, Earthquakes,
ns.

he more significant hydrogeologic and
l aspects of the Tennessee-Tombigbee Waterway are summarized. Some typical engineering and environmental problems are covered, along with a few of the more complex problems and how they were dealt with at specific sites. The concentration is primarily on the River and Canal sections of the Waterway. The general geologic setting is described with emphasis on seismicity, and mineral resources. Groundwater hydrology is described including hydrogeologic conditions along the flood plain, environmental and pre-construction investigations. Geotechnical explorations and design studies are reviewed along with optimizing conditions for the locating of locks and dams, the adaptation of design and construct to geologic conditions, construction dewatering for river and canal sections, impact on hydrogeologic and geologic environment, and continued monitoring and evaluation tasks. (Baker-IVI)
W86-00334

8F. Concrete

DESIGN OF DOWELS FOR ANCHORING REPLACEMENT CONCRETE TO VERTICAL LOCK WALLS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
T. C. Liu, and T. C. Holland.
Technical Report SL-81-1, March 1981. Final Report. 77 p, 42 Fig, 13 Tab, 17 Ref, 2 Append.

Descriptors: *Concrete construction, *Steel, *Locks, Dowels, Design criteria, Waterways, Shear tests, Resins.

Dowel pullout tests and shear transfer tests were performed to evaluate the pullout performance of dowels and the influence of dowel spacing on the load carrying capacity of replacement concrete cast during rehabilitation of vertical walls in navigation locks. The dowels were installed with a polyester resin cartridge system. For embedment lengths less than 15 times the dowel diameter, failure was generally caused by slippage along the concrete-resin interface. Performance of dowels installed under field conditions was acceptable. Within the range of the percentage of steel used in the laboratory shear transfer tests, the effect of the dowels did not appear to increase significantly the load-carrying capacity of the test specimens. The bond between the new and old concrete was more significant than the amount of steel present. The coefficient of friction between the new and old concrete was 1.35. In failure tests two modes were observed. In specimens without dowels the new concrete suddenly dropped onto the old concrete. In specimens with dowels the dowels prevented complete separation of the two pieces of concrete.
W86-00312

CONCRETE PERFORMANCE AT PUEBLO DAM, COLORADO: INITIAL CORE REPORT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
L. G. Mogck, and E. R. Dunstan.
Report No. GR-80-7, March 1982. 38 p, 10 Fig, 8 Tab, 6 Ref.

Descriptors: *Concrete technology, *Concrete testing, *Strength, Elastic properties, *Physical properties, *Concrete mixes, Concretes, Cores, Tensile strength, Compressive strength, Poisson ratio, Pozzolans, Pueblo Dam, Colorado.

Physical properties of initial cores extracted from the dam and river plug at Pueblo Dam, Colorado, indicate a good quality, uniform, well-consolidated concrete. This study is part of a series in the long-term evaluations of strength and elastic properties of concrete in various dams. The river plug concrete included two mix designs designated as interior and exterior. The dam concrete included two mix designs noted as high of low water to cement plus fly ash ratio. Results of the tests on the 3-year cores from the river plug show the average compressive strength of the concrete to be about 40 MPa, with no increase over the 6-month strength. The average 1-year dam concrete compressive strength was about 30 MPa, which is an increase over that at 6 months age. The modulus of elasticity for the interior plug concrete at 3 years is about 30 GPa with no significant increase with age. The 1-year dam concrete modulus of elasticity is about 35 GPa. Poisson's ratio, density, mix design, and tensile strengths of construction joints and monolithic specimens are also discussed.
W86-00380

CEMENT-MODIFIED SOIL IN CANAL LINING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. W. Jones.
Report No. GR-82-4, August 1982. 31 p, 14 Fig, 3 Tab, 13 Ref, 2 Append.

Descriptors: *Cements, *Canal linings, *Erosion control, *Soil stabilization, *Soil cement, Canals, Silt, Loess, Portland cements, Erosion, Driftwood Canal.

In 1958, test sections of silty loessial soil lining treated with portland cement were installed on one side of the Driftwood Canal to resist erosion from water action. This canal, located near McCook, Nebraska, has a capacity of 6.3 cu m/s. The cement, in amounts of 4.5 percent by volume for one section and 2.5 percent for another was mixed with the soil in 600-mm-wide horizontal strips in the lining, which was otherwise constructed as a normal thick-compacted soil lining. In 1981, the cement-treated soil was sampled and laboratory compressive strength and durability tests were performed. Although the soil with 4.5 percent cement was cracked and had a blocky structure, it has resisted erosion reasonably well, even on a curve. The test reach with 2.5 percent cement resisted erosion slightly better on a straight section than the opposite untreated side. However, this section did not contain sufficient cement to adequately resist erosion on a curve.
W86-00381

CONCRETE PERFORMANCE IN MORROW POINT DAM: 10-YEAR CORE REPORT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
O. R. Werner, and D. Mudrick.
Report No. GR-81-5, March 1981. 44 p, 7 Fig, 7 Tab, 1 Append.

Descriptors: *Concrete technology, *Cores, *Concrete testing, *Strength, *Elastic properties, *Physical properties, *Concrete dams, *Mass concrete, Tensile strength, Compressive strength, Poisson ratio, Morrow Point Dam, Colorado.

The Bureau of Reclamation monitors the structural behavior of concrete dams for many years after completion. Concrete core evaluation programs are also conducted at various ages on major dams. This report presents test results on concrete cores taken from Morrow Point Dam up to 10 years' age. The physical properties tests conducted on 250-mm(10-in) diameter cores at 60 days, 180 days, 1 year, 5 years, and 10 years indicate that overall condition of the concrete is good. The thin-arch design used at Morrow Point required a higher than normal compressive strength for mass concrete. Most mass concrete dams built previously contained interior and exterior mixes; however, with the higher compressive strengths maintained at Morrow Point, a single mix was sufficient for the entire structure. The compressive strength of the mass concrete at 10 years averaged 51.6 MPa (7,480 lb/sq in). Also at 10 years, the modulus of elasticity and Poisson's ratio averaged 35.1 GPa (5,090,000 lb/sq in) and 0.24, respectively. The tensile strength of all cores tested at 10 years averaged 1.59 MPa (230 lb/sq in), which is comparable to tensile strengths for other Service dams.
W86-00384

CONCRETE PERFORMANCE IN CRYSTAL DAM, COLORADO: 1-YEAR CORE REPORT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
T. A. Gaeto.
Report No. GR-81-8, June 1983. 30 p, 9 Fig, 3 Tab,

Field 8—ENGINEERING WORKS

Group 8F—Concrete

4 Ref.

Descriptors: *Concrete testing, *Concrete dams, *Concrete technology, *Strength, *Elastic properties, *Physical properties, Concretes, Cores, Tensile strength, Compressive strength, Poisson Ratio, Construction joints, Crystal Dam, Colorado.

Results of physical properties tests conducted on cores extracted from mass concrete in Crystal Dam for testing at 70 days', 6 months, and 1 year's age indicate good quality, uniform, well-consolidated concrete. This report contains test data through 1 year's age and is a part of a series of reports on long-time evaluations of strength and elastic properties of concrete in major Bureau of Reclamation dams. The average compressive strengths at 6 months and 1 year were 33.7 and 35.0 MPa (4,890 and 5,080 lb/sq in), respectively, which represent an average strength gain of 3.9 percent. Paralleling the strength increase, the moduli of elasticity also increased slightly from 31.4 to 31.7 GPa (4,550,000 to 4,600,000 lb/sq in). Tensile strengths for jointed and nonjointed cores were comparable at 6 months, but the nonjointed 1-year tensile strengths averaged 40 percent higher. Ratios of tensile to compressive strengths were high, indicating good paste-aggregate bond. Discussions of test results, variations, construction joint bond, and Poisson's ratio are also included in the report.
W86-00385

8G. Materials

STANDARD NUMBER 54: FLEXIBLE MEMBRANE LINERS.
National Sanitation Foundation, Ann Arbor, MI. November 1983. 70 p, 15 Tab, 8 Append.

Descriptors: *Materials engineering, *Polymers, *Plastics, *Membranes, *Linings, Polyethylene, Polyvinyl chloride, Rubber, Epichlorohydrin polymer.

Standards for flexible membranes are given for many polymeric materials. Of particular interest are standards for potable water applications, the aquatic environment, and construction. Flexible membranes used in fishing ponds, agriculture, fish hatcheries, and recreational reservoirs should not adversely affect the environment. If information on prior use of a particular membrane is not available, special studies may be required. Properties of the following materials are given: polyvinyl chloride, chlorinated polyethylene, butyl rubber, polychloroprene, high density polyethylene, ethylene-propylene diene terpolymer, epichlorohydrin polymers, polyethylene ethylene-propylene alloy, high density polyethylene elastomeric alloy, chlorosulfonated polyethylene, thermoplastic nitrile, ethylene interpolymer alloy, and chlorinated polyethylene alloy.
W86-00320

GENESIS OF THE PROTECTIVE LAYERS UPON THE MILD STEEL SURFACE IN THE NEUTRAL NATURAL WATERS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia).
V. Bischof, and J. Eliasek.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 531-537, 1984. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Corrosion, *Steel, *Protective layers, Drinking water, Chlorides, Dissolved oxygen, Carbonates, Sulfates, Calcium, Magnitite, Alkaline earths.

Corrosion of mild steel in waters with dissolved oxygen takes place mostly with oxygen depolarization as the main reaction. The surface layer consists of the corrosion products and constituents of the surroundings. The formation of protective layers against corrosion was investigated by experiments performed in three different media: drinking water, drinking water enriched by chlorides and a concentrated chloride solution. The conditions for protective layer formation on mild steel in neutral water are given by the concentration of calcium and bicarbonate ions, which form layers of CaCO3 and FeCO3. During corrison processes nonstoichiometric hydrated magnetite is first formed. It is gradually oxidized and its structure changes to FeOH.H2O. The natural water components increase the oxidation rate, they yield crystallization nuclei, and they affect the space structure of compounds formed during corrosion reactions. A high availability of alkaline earths and hydrogen carbonate allows the formation of a protective layer consisting of FeOOH.H2O, CaCO3 and FeCO3. (Baker-IVI)
W86-00419

8I. Fisheries Engineering

HABITAT DEVELOPMENT FOR FRESHWATER MOLLUSKS IN THE TOMBIGBEE RIVER NEAR COLUMBUS, MISSISSIPPI,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. C. Miller.
In: Report of Freshwater Mollusks Workshop, May 19-20, 1981, Vicksburg, MS. Final Report, May 1982. p 86-94, 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Environmental effects, *Rivers, *Aquatic habitats, *Mollusks, Shellfish, Tombigbee River, Aquatic insects, Insects, Riffles, Channel improvement, Habitats.

The U.S. Army Engineer Waterways Experiment Station has begun a project to design and monitor a gravel bar habitat for aquatic insects and mollusks. This bar will be placed in the Tombigbee River near Columbus, Mississippi, river mile 232.9. This study has been divided into three phases: biological evaluation of the project area (to be initiated in the summer of 1981), design of the bar or bars, and subsequent monitoring of the habitat after construction by the U.S. Army Engineer District, Mobile. (Author)
W86-00330

COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM ANNUAL REPORT - F.Y. 1981,
National Marine Fisheries Service, Seattle, WA.
R. Z. Smith, and E. Wold.
Available from the National Technical Information Service, Springfield, VA 22162 as PB83-11452 0. NOAA Technical Memorandum NMFS F/NWR-4, July 1982. 51 p. 13 Fig, 6 Tab, Append.

Descriptors: *Fisheries, *Fish hatcheries, Cost analysis, *Columbia river basin, Fish ladders, Salmon, Water pollution sources, Water pollution control.

FY 1981 was a very active year for the Columbia River Fisheries Development Program. Twenty-two hatcheries and two rearing ponds made releases during the year. The Toutle Hatchery, destroyed by the eruption of Mt. St. Helens, was mothballed until the habitat improves enough for anadromous fish to live in the Toutle River Basin. Stream improvement and irrigation diversion screening operated on a maintenance level. Only a few diversions in Idaho remain to be screened. All fish ladders were inspected by the operating agencies and repaired where necessary prior to the adult migration runs. Almost 3.5 million marked fall chinook were released from 18 hatcheries, of which 12 were funded under the Program, in 1981. One more year of marking remains in this four-year study. Initial data show that the fish are being caught in all the same fisheries as were fish from the 1961-64 fall chinook study. In 1981, the Program became directly involved with fish transportation in the Columbia River Basin. A total of > 8 million juvenile salmonids were trapped at Lower Granite, Little Goose, and McNary Dams and trucked/barged to a release site below Bonneville Dam. Activities during 1981 were mainly operational. By the close of 1981, pollution abatement facilities were completed and in operation at all Program hatcheries.
W86-00347

INFLUENCE OF THE FISH CLARIAS BA CHUS ON THE PHYSICOCHEMICAL P ERTIES OF WATER UNDER LABORAT CONDITIONS,
Kalyani Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-00401

EVALUATION OF INSTREAM ENHA MENT STRUCTURES FOR SALMO SPAWNING AND REARING IN A COAS OREGON STREAM,
Bureau of Land Management, Salem, OR. S District.
R. A. House, and P. L. Boehne.
North American Journal of Fisheries Manage Vol. 5, p 283-295, Spring, 1985. 5 Fig, 6 Ta Ref.

Descriptors: *Fisheries engineering, *Strea hancement structures, *East Fork Lobster C *Oregon, Salmon, Trout, Spawning, Stream Stream rehabilitation.

East Fork Lobster Creek, Oregon is an exam a stream that lost much of its productivity anadromous salmonid stream following loggi tivities, intensive stream cleaning, and flo The stream in the study area was almost dev instream structures, resulting in a nearly tota of spawning gravel and rearing habitat. S enhancement structures installed in East Fork ster Creek were successful and functional afte winters with usual freshets. The structures matically increased the diversity of the strea trapped gravel, and created shallow grave and deep, covered pools. Also, the number and quality of the pools increased in areas structures. Coho salmon (Oncorhynchus ki and steelhead (Salmo gairdneri) spawnin creased substantially, as well as the numb rearing coho, steelhead fry, and steelhead an throat trout (Salmo clarki) parr. This study that similar degraded streams can be rehabil by properly designed enhancement prog Such programs are effective and are need help ensure the protection of naturally spa and rearing wild salmonid stocks and the su of their young. (Author's abstract)
W86-00591

10. SCIENTIFIC AND TECHNICAL INFORMATI

10D. Specialized Information Center Services

HAZARDOUS MATERIALS SPILLS-MAN MENT REVIEW,
Texas Transportation Inst., College Station.
J. T. Lamkin, D. P. Honan, J. A. Nickerson, Payne, and R. C. Speaks.
American Petroleum Institute, Washington, 1981, 414 p. 5 Fig, 2 Tab, 5 Append.

Descriptors: *Oil spills, *Data collections, views, *Environmental protection, *Haz materials, *Transportation, *Education, transmission, Data storage and retrieval, Da quisition, Federal government, State govern Management planning, Education, Training.

This study, funded by the American Petr Institute, addresses the problems associated the safe and efficient transport of hazardous rials through the development of a materials portation data base. It provides a state-of-t examination of various inputs to the haz transportation file by providing the foundati a broad based and comprehensive data bas level of involvement by the federal gover and state agencies in the field of hazardous m als transportation is documented. Methods fo development, maintenance, and disseminat the federal and state level are identified. Pla emergency response in the event of a haz material spill are outlined. The U.S. Environ Protection Agency is the agency responsib

ring the effects of a hazardous material spill land, air, water, or biosphere. Existing onal, training and technical programs for personnel involved in hazardous material transportation and spills cleanup are listed. Legislation and regulations concerning the transportation of hazardous materials are reviewed.
W86-00350

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MARCH 1986

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PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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SELECTED WATER RESOURCES ABSTRACTS

ATER CYCLE

General

LING HYDROCLIMATIC PROCESSES RGE WATERSHEDS,
nia Univ., Davis. Dept. of Geography.
Shelton.
of the Association of American Geo-s, Vol. 75, No. 2, p 185-202, January, 1985. Tab, 42 Ref.

tors: *Model studies, *Watershed, *Rain-off relationships, *Deschutes River Basin, n, *Hydrologic models, Climatology, Spa-ribution, Simulation.

lly disaggregate moisture budget (SDMB) ed model is presented. The model is de-to simulate the hydrologic response of a eterogeneous basin by emphasizing mois-counting within functionally discrete units the horizontal and vertical dimensions. on of the precipitation-runoff process is d by dividing the watershed into homoge-omains or sectors that act independently. ctor is represented vertically as a four-nfiguration composed of surface, soil root transient groundwater, and perennial vater subsystems joined in series. The re-f the total watershed is represented by an ghted combination of moisture fluxes for he separate sectors. Averaging or lumping l variables achieved through spatial disag-n of the watershed helps to reduce uncer-oncerning the mangitudes and the spatial oral attributes of inputs, outputs, and stor-is conceptual structure permits the model readily available climatic data, to incor-prior knowledge of the physical charac-f the watershed, and to be adaptable for g land use changes. Analysis of spatial and variations in hydroclimatic processes in hutes River Basin in Oregon demonstrates y of the model to simulate the transforma-recipitation into runoff in a complex hy-setting. (Baker-IVI)
47

OF BACTERIAL MORTALITY IN C ENVIRONMENTS,
Univ. (Belgium). Lab. d'Oceanographie.
s, G. Billen, and J. V. Rego.
and Environmental Microbiology, Vol. , p 1448-1454, June, 1985. 10 Fig, 1 Tab, yndicat des Communes de la Banlieue de r les Eaux contract 30/83 and EEC con-V-522-B(RS).

rs: *Bacteria, *Mortality, *Aquatic envi-Radioisotope studies, Tritium, Zooplank-ing, Filtration.

l is proposed which provides a minimum f the rate of bacterial mortality in grow-l populations of planktonic bacteria. This s given by the rate of decrease of radioac-m the DNA of a tritiated thymidine-atural assemblage of bacterial after all ymidine has been exhausted from the Results obtained from river water, estua-r, and seawater show overall bacterial rates in the range 0.010 to 0.030/h, in eement with the range of growth rates in the same environments. Use of selec-ion through Nuclepore filters (pore size, llowed the determination of the contribu-crozooplankton grazing to overall bacte-ality. Grazing rates estimated by this anged from 0 to 0.02/h. (Author's ab-
7

G WATER RESOURCES,
Tects Research Lab., Research Triangle Criteria and Special Studies Office.
p.
sources Bulletin, Vol. 21, No. 2, p 291-1985. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Water resources, *Streams, *Rivers, Stream order, Stream morphology, Flow discharge, Water management.

Using data related to stream order and the morphological characteristics associated with streams of different discharge rates, an estimate of the river resources of the United States is made. The national totals are: 3,200,000 miles total length of rivers; 15,000 square miles of river surface; and 29 cubic miles of water stored in river channels. Using the same techniques, more exact estimates may be made for individual river basins. Suggestions are given for application of the techniques and river data in the management of water resources. (Author's abstract)
W86-00791

INFLUENCES OF SNOW COVER AND SOIL MOISTURE ON MONTHLY AIR TEMPERATURE,
Illinois Univ. at Urbana-Champaign. Dept. of Atmospheric Sciences.
J. E. Walsh, W. H. Jasperson, and B. Ross.
Monthly Weather Review, Vol. 113, p 756-768, 1985. 15 Fig, 1 Tab, 31 Ref. NSF grant ATM-8313726.

Descriptors: *Snow cover, *Soil water, *Air temperature, Climatology, Precipitation, Model studies, Monthly variation, Seasonal variation.

A series of objective specification experiments were performed with monthly 700 mb heights and surface station temperatures for the United States during 1947-80. The errors in these specifications were used in conjunction with observed snow cover and a computed soil moisture index to assess the impacts of a variable surface state on monthly surface air temperature. Over the eastern and central United States, the mean errors of temperature specifications for the winter months vary by 1-2 C according to the sign of the anomaly of snow cover. Lag results suggest that snow cover can make a modest contribution to the skill of temperature predictions near the snow boundary. The summer specifications were evaluated in terms of a soil moisture index computed from monthly temperatures and precipitation amounts using a modified Thornthwaite/Nappo parameterization scheme. This index varies seasonally in a realistic manner, while the corresponding mean annual runoff is shown to agree well with runoff amounts derived from observed streamflow data. The soil moisture index shows coherent and physically plausible associations with temperature in the central and western United States. In these regions, the mean errors of the temperature specifications vary by approximately 0.5 C according to the sign of the soil moisture anomaly. Impacts of this magnitude are smaller than those obtained in recent general circulation model experiments, but are statistically significant at most stations in the west-central portion of the country.
W86-00860

2B. Precipitation

SEASONAL PRECIPITATION FORECASTING WITH A 6-7 MONTH LEAD TIME IN THE PACIFIC NORTHWEST USING AN INFORMATION THEORETIC MODEL,
Entropy Ltd., Lincoln, MA.
R. A. Christensen, and R. F. Eilbert.
Monthly Weather Review, Vol. 113, No. 4, p 502-518, April, 1985. 6 Fig, 13 Tab, 43 Ref, 2 Append.

Descriptors: *Precipitation, *Forecasting, *Model studies, *Washington, *Oregon, Entropy minimax analysis, Seasonal variation, Prediction, Statistical analysis.

An entropy minimax analysis for the forecast of seasonal precipitation with a 6-7 month lead time was performed for two regions in the Pacific Northwest. A model for the forecast of winter precipitation in the Willamette Valley, Oregon was developed using the 92 year period 1854-1945 for model building. Predictions made for the reserved test years 1946-82 had a 74% accuracy. Statistical test establish a 99% confidence that this success is not due to chance. Models for the forecast of winter and spring precipitation in eastern Washington were developed using the 73 year period 1873-1945. The winter model had 69% predictive accuracy on the test years, with a 97% confidence agains chance. The spring model had an accuracy of 54%, which is statistically indistinguishable from chance. Further analysis reveals that the spring model had an accuracy of 67% for the period 1946-63 and 43% for the period 1964-82, with an 88% confidence against the accuracy decrease arising from chance. This suggests a marginal validity period for the spring model in the order of 15 years following the model building period. The accuracies of the winter model for both western Oregon and eastern Washington show fair uniformity throughout the 37 year test period, with a slight downward trend in the later portion. (Author's abstract)
W86-00778

RAIN ESTIMATION IN EXTRATROPICAL CYCLONES USING GMS IMAGERY,
Bureau of Meteorology, Melbourne (Australia).
R. DelBeato, and S. L. Barrell.
Monthly Weather Review, Vol. 113, p 747-755, May, 1985. 8 Fig, 1 Tab, 14 Ref, 1 Append.

Descriptors: *Rainfall distribution, *Japanese Geostationary Meteorological Satellite, *Remote sensing, *Cyclones, *Australia, Clouds, Blackbody temperature, Satellites, Meteorology, Data interpretation.

A technique was developed which provides estimates of rainfall from extratropical cyclones over an area of 125,000 sq km in southeastern Australia in simulated real time conditions. It utilizes a statistical relation between blackbody temperature of cumuliform cloud and 90 minute rainfall totals to determine estimates of rainfall from cumuliform cloud, and approximates the lesser rainfall amounts from the stratiform pre-frontal cloud as a fixed proportion of rain from equivalent cumuliform cloud. It is based on the digitized 'HR Fax' imagery received at 3 h intervals from the Japanese Geostationary Meteorological Satellite (GMS). Five case studies are presented, each for a 24 hour period. Rainfall estimates for rainfall districts within the area vary from the observed district averages, which were calculated from daily gage data, by an average of 22%. The mean absolute error for districts is 4.2 mm. (Author's abstract)
W86-00859

2C. Snow, Ice, and Frost

SNOWMELT ENERGY BUDGETS IN SOUTHERN AND EAST-CENTRAL WISCONSIN,
San Diego State Univ., CA. Dept. of Geography.
E. Aguado.
Annals of the Association of American Geographers, Vol. 75, No. 2, p 203-211, June, 1985. 6 Fig, 4 Tab, 16 Ref.

Descriptors: *Snowmelt, *Energy budget, *Wisconsin, Solar radiation, Snowpack, Melting, Melt water, Computers, Simulation, Model studies.

Computer simulation has been used to understand the energy balance characteristics of melting covers in the open in southern and east central Wisconsin. The formulation and testing of a descriptive model of snowmelt that relates the phenomenon to previous episodes of accumulation and melt, rather than simply to current meteorological and irradiance conditions, was also explored. Sensible heat flux into the snow was the greatest source of melt energy throughout the 12 years for the majority of days and episodes. Solar irradiation frequently dominated the energy regime, especially when melt occurred late in the season and after large snow accumulations. The effect of prior accumulation and melt on snowpack energetics was discussed and illustrated by the results of the model applied to a year with an unusually deep and long standing snowpack. Snowmelt in Wisconsin occurs throughout a wide range of meteorological and solar irradiance conditions. As the devel-

opment of temperature index models is dependent on the assumption that the relative importance of turbulent and radiative fluxes is nearly invariant, it is unlikely that simple predictive equations are going to be formulated. Such models must include the time of year and the responsiveness of the snow to the various heat inputs. (Baker-IVI)
W86-00648

ESTIMATING REGIONAL SNOW WATER EQUIVALENT WITH A SIMPLE SIMULATION MODEL,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
R. C. Kattelmann, N. H. Berg, and M. K. Pack.
Water Resources Bulletin, Vol. 21, No. 2, p 273-280, April, 1985. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Snowpack, *Simulation, *Computer models, Model studies, Water equivalent, Precipitation, Air temperature, Snowmelt, Rainfall, Snow cover.

A simple water balance approach is applied to snowpack in this simulation model. Solid precipitation increases snowpack water equivalent as does rain in amount less than the water holding capacity. Rain in excess of the retention capability drains through the pack without adding to the water equivalent. Melting reduces the water equivalent when the pack is saturated with liquid water. The model estimates average snow water equivalent for rectangular subregions in the area. A snowpack water balance is maintained for each subregion on the basis of the average meteorological conditions calculated for the particular subregion. Static subregion characteristics, daily precipitation and mean and minimum air temperatures measured at three index stations are the only needed input values. The model was developed empirically, and each component represents an average condition within the ranges of different meteorological events. Unusual events at the extremes of these ranges may be poorly simulated. The model appears to perform well as indicated by comparison with point measurements of snowpack water equivalent. The mode has a relatively short computer program and run-time, and produces easily interpretable output. (Moore-IVI)
W86-00789

2E. Streamflow and Runoff

STOCHASTIC FLOOD ANALYSIS IN A REGION OF MIXED GENERATING PROCESSES,
Saskatchewan Univ., Saskatoon. Dept. of Geography.
P. R. Waylen.
Transactions of the Institute of British Geography, Vol. 10, No. 1, p 95-108, 1985. 14 Fig, 2 Tab, 22 Ref.

Descriptors: *Stochastic hydrology, *Flood analysis, *British Columbia, Spatial distribution, Flood control, Floods, Streamflow, Snowmelt, Rainfall.

Partial series were obtained from streamflow records of seventeen drainage basins located in southwestern British Columbia. The selection of partial series as a method for analyzing the flood hydrology of a region provides a readily applicable technique which maximizes the use of sample data and provides additional valuable information concerning the frequency and timing of floods. The method is sufficiently flexible that it may be used in a variety of physical environments to provide a satisfactory statistical fit and yet remain physically interpretable. Basins experiencing snowmelt, rainfall and mixed process generated floods are successfuly analyzed in areas receiving between 300 and 3000 mm of annual precipitation. The choice of probability distributions is theoretically based, parameters are estimated easily and permit spatial comparison. The changing values of parameter estimates are strongly linked to the regional flood generating processes. A great deal of their observed spatial variability is explained by changes in the frequency domain of such events rather than their magnitude and timing. In light of these observations a regional approach and extrapolation of process based parameter estimates to basins of interest may be an alternative method of dealing with unusual outliers in flood series. Present engineering practice is to either interpolate between empirical plotting positions or to selectively discard such events. Both techniques lead to poor flood frequency estimates and the loss of valuable regional hydrologic information. Partial series provide the basis of the analysis of annual floods and daily maxima and should be considered as a potential method of analyzing other hydrometeorological extremes. (Baker-IVI)
W86-00646

SNOWMELT ENERGY BUDGETS IN SOUTHERN AND EAST-CENTRAL WISCONSIN,
San Diego State Univ., CA. Dept. of Geography.
For primary bibliographic entry see Field 2C.
W86-00648

STORM WATER RUNOFF FROM INDUSTRIAL SITES,
Baxter and Woodman, Inc., Crystal Lake, IL.
For primary bibliographic entry see Field 5B.
W86-00766

APPLICATION OF SIMPLE MOISTURE ACCOUNTING MODELS TO UNGAUGED CATCHMENTS,
Severn-Trent Water Authority (England).
J. Pirt, and E. A. Bramley.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 2, p 169-177, April, 1985. 5 Fig, 5 Tab, 6 Ref.

Descriptors: *Runoff, *Mathematical models, *Moisture accounting models, Geology, Morphology, Flow forecasting, Simulation, Design flow, Baseflow, Channel routing, Hydrological models, Model studies, England.

Adaptation of a simple, isolated events model (IEM4) to ungauged areas, using catchment geology and morphology to estimate model parameters, produced encouraging estimates of model parameters for design flow prediction, real-time flow forecasting, and flow simulation. The model involves eight parameters: 'groundwater reservoir factor' controlling the rate of baseflow, 'channel routing factor' controlling the effect of channel size on hydrograph shape, 'time delay before hydrograph rise', 'duration of hydrography response', 'runoff percentage at zero soil moisture deficit (SMD)', 'decay rate of run-off percentage/SMD function', 'maximum runoff percentage' under saturated soil conditions, and 'maximum percolation rate' to groundwater under saturated soil conditions. Accuracy and reliability of the model and parameter estimation equations were tested on four catchments in England which differed in geology and topography and ranged in size from 50-165 sq km. Flow forecasts were made for three events in each catchment in pseudo real time. The results in Kingston Brook to Kingston and the River Dove to Kirkby Mills had average errors of estimated peak flows and total runoff volumes of 2.5% and 6.6%, respectively. Timings of the peak flows were also accurate. For the Ecclesbourne and Rother catchments, there were noticeable discrepancies in hydrograph shape and volume, but major errors were restricted to only two events, in which hydrograph peak, total volume, and timing were all in error. (Rochester-IVI)
W86-00836

ALLUVIAL FANS: NOVEL FLOOD CHALLENGE,
Riverside County Flood Control and Water Conservation District, CA.
K. L. Edwards, and J. Thielmann.
Civil Engineering, Vol 54, No. 11, p 66-68, November, 1984. 2 Fig.

Descriptors: *Alluvial fans, *Flood plain management, *Carbozon, *California, Land use, Zoning, Flood protection.

Theoretical considerations, combined with information derived from prior flood events, were used to develop a flood management plan for Ca
California, which had been severely dama
flooding. There had been six major floods in
side County within the preceding 5 yr wh
study was undertaken. In the upstream rea
the study area, steep slopes of 2-3%, coupl
the erodible alluvial bed material, produce
and erratic lateral and vertical erosion in th
channel, which may change its course dram
during floods. The Dawdy method of pre
channel geometry was used with the modi
that Manning's equation was substituted for
depth. The revised method predicted velo
10-25 ft/sec, channel depths of 1-3 ft, and
widths of 100-500 ft in the 100-yr flood
figures agreed reasonably well with field m
ments of recent alluvial floods in the area. I
to allow for flood flow, minimum lot sizes
alluvial fans in Carbazon were specified
third acre and one-half for two of the fans,
35% of each lot had to remain open to pas
waters. In areas of Carbazon where flow ve
of 15 ft/sec or higher were expected, no d
ment was recommended; some developmen
be permitted in areas of lower predicted ve
but subject to strict floodproofing and d
ment density limits. (Rochester-IVI)
W86-00885

2F. Groundwater

**SEISMIC MICROACTIVITY AND W
LEVEL VARIATION IN INDUSTRIAL
NEAR FLORENCE (ITALY),**
Florence Univ. (Italy). Ist. di Geologia e P
logia.
G. Gabbani.
Bollettino della Societa Geologica Italia
103, No. 1, p 87-95, 1984. 9 Fig, 17 Ref.

Descriptors: *Florence, *Italy, *Seis
*Groundwater withdrawals, Water level,
al development, Geological fractures.

Analysis of seismic microevents close to th
Seismological Station (Florence, Italy) sh
puzzling regularity: the seismicity was pr
absent during the night and holidays,
increased during the working hours, rea
peak in the late afternoon and then sharply
ing. Through the use of a portable seismo
was possible to ascertain with reasonabl
dence that the origin of the microseism
located under the industrial settlement of
murlo. This particular settlement has grow
last 20 years. Microevents recorded with
tudes of 1.6-1.9 and distances of about 7.0
selected and their daily and weekly distr
were compared with corresponding trend
groundwater withdrawal due to the indus
tivities. Fluctuations of the ground wat
paralleled the occurrence of microse
Withdrawals may induce displacements in
faults or fractures. (Baker-IVI)
W86-00632

**SECURITY OF GROUNDWATER C
MENTS NEAR RIVERS; CHARTS TO
MINE THE VARIATION IN THE REPL
MENT FLOW (SURETE DES CA
D'EAU SOUTERRAINE A PROXIMI
RIVIERES; ABAQUES POUR DETER
L'EVOLUTION DU DEBIT DE REALI
TION FLOW),**
Laboratoire National d'Hydraulique,
(France).
J. P. Bouchard.
Houille Blanche, No. 1, p 53-71, 1985. 9
Fig.

Descriptors: *Groundwater recharge,
table, *Water quality control, Aquifers, F
Boreholes, Computers, Rivers, Water
control, Hydrodynamics.

The security of catchments of ground wa
alluvial water table as regards the pollutio
river requires being able to predict the
changes in the flowrates and volumes
water drawn to the borehole when pu

d. These values were determined by a com-
rogram for different cases and are shown on
The parameters taken into account are the
lynamic characteristics of the water table,
wrate and geometry of pumping, the lateral
shment of the water table and possible ob-
n of the riverbed. (Author's abstract)
)656

**T OF GROUNDWATER ON SOIL FOR-
ON IN A MORAINAL LANDSCAPE IN
TCHEWAN,**
hewan Univ., Saskatoon. Saskatchewan
Pedology.
ller, D. F. Acton, and R. J. St. Arnaud.
n Journal of Soil Science, Vol. 65, No. 2, p
, May, 1985. 9 Fig, 2 Tab, 15 Ref.

tors: *Groundwater, *Moraines, *Sas-
van, *Soil genesis, Water table, Recharge,
ge, Soluble salts, Morphology, Carbonates,
g.

a given landscape position in the study area
imilar morphological and chemical charac-
the genesis of which can be related to soil
e regimes and groundwater flow. Based on
sults, it is possible to predict the hydrologi-
acteristics of a soil from its landscape posi-
rphology, and classification. Non-saline,
onated Humic Luvic Gleysols occurring
d depressions are associated with ground-
charge. Water tables are close to or above
surface following spring snowmelt runoff.
ltration of this water forms groundwater
under the depression, which decline
over the summer due to recharge and
ssipation. Leaching, as indicated by solum
variable between and within the sloughs,
be related to slough size, shedding area
for surface runoff, and to location within
r depressions. Soils at locally low eleva-
ude nonsaline and saline soils. Non-saline
found in depressions which receive snow-
off in the spring, and consequently are
f salts. Saline soils occur on lower slope
where the water table is always within 2-
the surface, and often within 2 m, ena-
capillary fringe to deposit carbonates and
lts close to the surface, through evapora-
rated flow may include recharge, dis-
r lateral flow. A wide range in soils
n cultivated uplands. Soils on convex
generally shallow and associated with a
er table and mainly recharge and lateral
ter flow. Differences in the genesis of
s result from the degree of slope-influ-
isture redistribution rather than from
ated infiltration. Soils on concave slopes
lated to a high water table and/or possi-
tion above frozen subsoil in the spring.
D)
0

**AWDOWN AND CONSTANT-RATE
G TESTS,**
drich.
Journal, Vol. 39, No. 5, p 39-42, May,
b.

rs: *Step-drawdown tests, *Constant-rate
ests, *Pumping tests, *Aquifers, Ground-
lls, Pumps, Well yield, Unconsolidated

down tests are used to ascertain the
rformance of an aquifer, the well, and
Such tests are commonly used to check
rformance of new or established wells
in unconsolidated aquifers. Specific in-
for conducting step-drawdown and con-
pumping tests are given, including set-
ment, and management during the tests.
s of a step-drawdown test are used to
approximate aquifer parameters, the
evelopment of a new well, well efficien-
operating condition of the pump. The
tested should be taken out of service at
prior to the test to establish a represent-
water level. When testing, discharge
monitored for sand and entrained air.

Constant-rate pumping tests are used to evaluate the yield capacity of an aquifer during extended periods of continuous pumping, usually for a minimum of 3 days. The pumping rate selected must be one that the aquifer, the well, and the pump are capable of maintaining. When properly performed, the test can ascertain the existence of aquifer recharge boundaries and barrier boundaries, and can provide information on the magnitudes of transmissivity and storativity, the two most important aquifer parameters. The tests can also be used to calculate the well's radius of influence. A base-line well should be located at least 1 mile from the pumping well in an unconfined aquifer and at least 2 miles away in a confined aquifer. The test is conducted ideally when ground water levels are at their seasonal low - in late September or October. Steps must be taken to ensure that discharged water does not flood nearby areas or infiltrate back into the aquifer. (Rochester-IVI)
W86-00712

HYDROGEOLOGICAL PROSPECTING GROUP AND TYPES OF MINERAL DEPOSITS FILLED WITH KARST WATER IN CHINA (IN CHINESE).
Acta Geologica Sinica, Vol. 58, No. 2, p 152-164, 1984. 7 Tab, 9 Ref.

Descriptors: *Geohydrology, *Karst, *Minerals, *China (Peoples Republic), Groundwater, Aquifers, Geological fractures, Karst hydrology, Altitude, Caverns, Groundwater level.

It is suggested in this article that the form of potential space filled with water in the karst aquifers is a very important factor to be considered in the classification of hydrogeological prospecting groups of mineral deposits filled with karst water in China. Difference in such spatial forms has relevant effects on the conditions of storage and flowage of the ground water concerned and hence also has great influence on the methods of hydrogeological prospecting and evaluation. The mineral deposits filled with karst water in China may thus be classified into three groups, i.e., mineral deposits filled mainly with karst water in corroded fissures, those in caverns and in ground-rivers, and those in karst passageways. The distribution, hydrogeological features and prospecting perculiarities of each one are duly described. The 'contact' relation, or rather, spatial relation, between the mineral deposits, whether mineral beds or ore bodies, and the rocks or rock formations filled with water also direct influence on the conditions of flow of the karst water into the open pits or underground mines and measures of its prevention. Hence it is an important factor governing the planning of hydrogeological prospecting, including concrete methods, amount of prospecting works, etc. Four types of the mineral deposits in question may be further subdivided on such a basis, viz., mineral deposits with the water-filling rock (rock formation), or karst aquifer, as the direct roof of the mineral beds or ore bodies, with those as the direct floor, with those in the roof but not in direct contact, and with those in the floor but not in direct contact. Among the factors to be taken into consideration in the concrete hydrogeological prospecting are the altitudinal relationships of the mineral deposits and the local base level (of erosion) as well as the ground water level, influence of the surface water, the area of water-filling rock formations (or the catchment area in the case of ground-river and passageway water), degree of development of faulting and fissuring and the conditions of karst collapses in the case of cavern water. The aforesaid groups or types may be divided into simple, intermediate and complex categories so far as the combined effects of these factors are considered. (Author's abstract)
W86-00897

FOSSIL WATER UNDER THE SINAI-NEGEV PENINSULA,
A. Issar.
Scientific American, Vol. 253, No. 1, p 104-110, July, 1985. 7 Fig.

Descriptors: *Aquifers, *Fossil water, *Sinai Desert, *Egypt, *Negev Desert, *Israel, Isotope studies, Springs, Wells, Water resources development, Geology, Geohydrology.

A study of water issuing from springs and wells scattered across the Sinai (Egypt) and the Negev (Israel) deserts has identified a great aquifer formed during the last glacial age. Satellite photographs of the region reveal surface characteristics consistent with subterranean geology that could support an aquifer. Carbon-14 dating puts the age of the water from springs and wells at 20,000 to 30,000 yr. The ages determined from C-14 dating agree with results of hydrological flow models. Water samples from the 'Ayun Musa, from the abandoned oil-exploration well dug into the Nubian sandstone layer in Nakhel and from the artesian wells in the Nubian sandstone layer near the Dead Sea all have the same relative amounts of deuterium and oxygen-18. The chemical and isotopic studies in conjunction with archaeological evidence suggest that the aquifer holds rainwater that was trapped during the most recent ice age. It has been calculated that the Nubian sandstone aquifer under the Sinai and the Negev holds 200 billion cu m of water, 70 billion cu m of which is under the Negev. Agricultural settlements in the Negev demonstrate that the water is low enough in salt content to be suitable for irrigation. (Moore-IVI)
W86-00911

2G. Water In Soils

DETERMINATION OF MOISTURE IN SOLIDS,
Lawrence Livermore National Lab., CA.
J. W. Pyper.
Analytic Chimica Acta, Vol. 170, No. 2, p 159-175, April 1985. 2 Fig, 91 Ref. U.S. DOE contract W-7405-Eng-48.

Descriptors: *Soil water, *Bound moisture, *Free moisture, Sampling, Measuring instruments, Dynamic dielectric thermal analysis, Coherent microwave measurements, Infrared spectrometry, Near-infrared reflectance spectrometry, Thermal methods, Nuclear magnetic resonance spectrometry.

The scientific literature published since Pande's comprehensive monograph Handbook of Moisture Determination and Control (1974) was surveyed (to mid-1984) for new or improved techniques of determining moisture in solids. Particular attention is given to methods that might distinguish between bound and free moisture in organic solids. The classification of moisture is discussed, as well as pitfalls in sampling, in sample handling, and in the comparison of different methods. Six methods that show promise of being able to distinguish between bound and free moisture were identified: dynamic dielectric thermal analysis, coherent microwave measurements, infrared spectrometry, near-infrared reflectance spectrometry, thermal methods and nuclear magnetic resonance spectrometry. (Author's abstract)
W86-00644

SURFACE SOIL WATER CONTENT MEASUREMENT USING PULSED NUCLEAR MAGNETIC RESONANCE TECHNIQUES,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
R. F. Paetzold, G. A. Matzkanin, and A. De Los Santos.
Soil Science Society of America Journal, Vol. 49, No. 3, p 537-540, May-June, 1985. 6 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil water, *Nuclear magnetic resonance, *Ground truth data, *Measuring instruments, Moisture probe, Soil type, Gravimetric water content.

A tractor-mounted nuclear magnetic resonance (NMR) soil moisture measurement instrument was developed and tested, demonstrating a high correlation between NMR output and volumetric and gravimetric soil moisture. This device may be used for obtaining ground truth data for calibrating and evaluating remotely sensed determinations. NMR

techniques can selectively measure only the hydrogen associated with water. The prototype instrument is composed of two major units, a sensor and an electronics package. The NMR sensor contains the electromagnet, the detection coil, and the tuning capacitor. The electronics package consists of the radio-frequency subsystem, the control and signal-processing subsystem, and the power distribution subsystems; the package is mounted on a 63 horsepower diesel tractor, along with a diesel generator that provides electrical power to the instrument. The sensor assembly has a mass of about 300 kg, and is mounted on the tractor's three-point hitch. Power is supplied to the magnet through the electronics package. About 300 watts are required to create a 55.7 kA/m field at 5 cm. A keyboard-type control console with a thermal printer is mounted inside the tractor cab. Measurement depths of 38, 51, or 63 mm can be selected here. Results are printed automatically, and additional notes can be typed with the output. Stationary measurements on a clay and loamy fine sand in buckets, yielded a linear relationship ($r=0.98$ at 38 mm, $r=0.99$ at 51 mm) between NMR signal and volumetric soil water content over the range 5-30% water by weight. Similarly, the gravimetric water content also showed a linear relationship with NMR values ($r=0.93$ at 38 cm, $r=0.96$ at 51 cm). In field tests in a clay loam and a gravelly sandy loam, gravimetric water content and NMR signal showed a linear correlation ($r=0.92$). Results with a stationary instrument or one moving at 26 cm/sec did not differ. Maintaining contact between the sensor and the soil surface was difficult in the clay loam soil. (Rochester-IVI)
W86-00698

SOLUTE DISPERSION DURING AXISYMMETRIC THREE-DIMENSIONAL UNSATURATED WATER FLOW,
Department of Scientific and Industrial Research, Palmerston North (New Zealand). Div. of Plant Physiology.
B. E. Clothier, and D. E. Elrick.
Soil Science Society of America Journal, Vol. 49, No. 3, p 552-556, May-June, 1985. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Solute transport, *Dispersion, *Unsaturated flow, Mathematical studies, Infiltration, Hydrodynamics, Convection, Wetting, Soil water, Bromides.

An approximate, analytic solution is presented for the smearing of solute by both convection and dispersion during axisymmetric three-dimensional constant flux infiltration from a surface point source in unsaturated soil. The steady-state pattern of axisymmetric streamlines is used to track individual parcels of water as they move away from the surface emitter. A simple analytic expression is developed to describe the time course of the hydrodynamic dispersion of solute about the convected front as it moves along any given streamline. The location of the convected front at any time is predicted from the profile of wetting along that streamline. The plane-of-separation concept is used to find the distance travelled by the convected front along the streamline. The invading solution is considered to act as if to effectively piston-displace the antecedent soil water. Profiles of bromide concentration along three streamline paths were measured during constant-flux point-source infiltration experiments in the laboratory with fine sand. These measurements compared favorably with the theoretical predictions. (Author's abstract)
W86-00700

SOLUTE DISCHARGE DURING STEADY WATER DRAINAGE FROM A SAND TANK,
Florida Univ., Gainesville. Dept. of Plant Pathology.
R. S. Mansell, P. J. McKenna, and M. E. Hall.
Soil Science Society of America Journal, Vol. 49, No. 3, p 556-562, May-June, 1985. 10 Fig, 2 Tab, 12 Ref.

Descriptors: *Drainage, *Solute transport, Simulation, Mathematical models, Saturated flow, Infiltration, Soil water, Boundary conditions, Breakthrough curve.

An alternating direction implicit (ADI) numerical method was used to simulate transient solute movement resulting from a step-function increase of solute concentration in water applied to a shallow sand tank system with a subsurface drain. Steady water flow in the saturated portion of the tank was simulated using an iterative alternating direction implicit (IADI) numerical method. The saturated-unsaturated condition in the actual sand tank was approximated by a smaller rectangular flow region of saturation in the model simulation. Isopleths of hydraulic head and solute concentration within the soil demonstrated a decrease in the rate of infiltration from the point vertically above the drain to the point vertically above the midpoint between the drains. Consequently, solute transport was much faster in the surface soil overlying the drain than in the soil near the mid-point between drains. When cumulative effluent volume was expressed as the number of pore volumes, breakthrough curves for solute concentration in the drainage water revealed early arrival of solute compared to a one-dimensional system. In spite of the different boundary conditions imposed at the soil surface in the tank and in the model, reasonable agreement was obtained between simulated breakthrough curves and experimental data from the sand tank. (Author's abstract)
W86-00701

MONTE-CARLO SIMULATION OF NONINTERACTING SOLUTE TRANSPORT IN A SPATIALLY HETEROGENEOUS SOIL,
Texas A and M Univ., College Station.
N. Persaud, J. V. Giraldez, and A. C. Chang.
Soil Science Society of America Journal, Vol. 49, No. 3, p 562-568, May-June, 1985. 5 Fig, 6 Tab, 26 Ref.

Descriptors: *Monte-Carlo process, *Simulation, *Solute transport, *Soil water, dispersion, Interstitial water, Velocity, Differential equations, Percolation.

Monte-Carlo data generation techniques were used to obtain 200 pairs multivariate lognormal values of the physical parameters D (dispersion coefficient) and v (pore-fluid velocity) which appear in the differential equation describing downward leaching of a noninteracting solute in the soil profile under steady-state percolation. The time (tmax), at which the maximum concentration is attained at given soil depth L after a pulse input of solute has been applied at the soil surface for a time t0, was obtained for each pair of generated D and v values. Values of the ratio delta L/delta tmax representing the average rate of movement of the maximum concentration between two depths were also calculated. The effect of changes in the variance of v and the levels of correlation between D and v on the frequency distribution of tmax-t0 was investigated. The lognormal and gamma distributions were fitted to the calculated distributions of tmax-t0. Good fits were obtained with both theoretical distributions to the values of tmax-t0. The lognormal distribution was better in describing the values of delta L/delta tmax. The parameters and properties of these calculated distributions were sensitive to changes in the variance of v but were less sensitive to changes in the correlation between D and v. The ensemble average of 200 concentration versus time curves was computed by substituting the generated parameters D and v in the solution to the differential equation. This curve was compared to that obtained using the sample mean values of D and v. The dissimilarity between these curves was sensitive to changes in the variance of v. (Author's abstract)
W86-00702

SEEPAGE-LIMITATION OPTIMIZATION OF THE SHAPE OF AN IRRIGATION CHANNEL BY THE INVERSE BOUNDARY-VALUE PROBLEM METHOD,
For primary bibliographic entry see Field 3F.
W86-00869

2H. Lakes

COMPARISON OF THE PHOSPHO CHLOROPHYLL RELATIONSHIPS IN M AND STRATIFIED LAKES,
Alberta Univ., Edmonton. Dept. of Zoology
E. T. Riley, and E. E. Prepas.
Canadian Journal of Fisheries and Aquati ences, Vol. 42, No. 4, p 831-835, April, 1985. 1 Tab, 19 Ref.

Descriptors: *Phosphorus, *Chlorophyll, * lakes, *Stratified lakes, Chlorophyll a, Th stratification, Nutrients.

Data from the literature were used to ca separate regressions of summer chlorophyll centration (Chl a) on spring total phosphoru centration (TP) for lakes that remain the stratified during the summer and lakes th intermittently during the summer. Significa ferences were found in the spring (TP)-u (Chl a) relationships for the two lake types 0.05). The mean ratios of summer (TP) to (TP) were also significantly different in st and mixed lakes ($P < 0.001$); this difference explanation offered for why the spring summer (Chl a) relationships were differ stratified and mixed lakes. (Author's abstract
W86-00614

DISTRIBUTION PATTERN OF DENIT ING BACTERIA IN FISH PONDS OF DI ING FARMING MANAGEMENTS,
Kalyani Univ. (India). Dept. of Zoology.
B. B. Jana, and G. N. Patel.
Archiv fur Hydrobiologia, Vol. 3, p 291-303 1985. 6 Fig, 4 Tab, 18 Ref.

Descriptors: *Denitrification, *Bacteria, ponds, Fish management, Fisheries, Fish fa Nutrients, Organic carbon, Nitrogen, Phos Population dynamics.

The population size of denitrifying bacte measured in fish ponds of differing fish f management practices. Due to different s combinations and rearing practices, it was h esized that there would be a difference population structure of denitrifying bacteria the ponds used for monoculture, polycultu traditional systems. Environmental factors sible for the seasonal variations of deni bacteria in these ponds were identified. Ma population in monoculture and lowest in tr al types were related to their enrichment ties in terms of organic carbon, inorganic n and phosphate. Seasonally, bacterial popu peaked in the summer and were reduced winter; harmonic analysis of empirical f with 12 ordinates was the best model to pre annual cycle of DNB in all fish ponds. S multiple regression analysis between the log of monthly numbers of bacteria occurring fish ponds and the environmental factors m that organic C, inorganic N, water temp and phosphate were perhaps important at causing seasonal changes of DNB in the ponds. (Baker-IVI)
W86-00622

EVALUATION BY FIELD EXPERIMEN THE MCLAY MODEL OF STREAM
British Columbia Univ., Vancouver. I Animal Resource Ecology.
P. A. Larkin, and D. W. McKone.
Canadian Journal of Fisheries and Aqua ences, Vol. 42, No. 5, p 909-918, May, 1985 6 Tab, 13 Ref.

Descriptors: *Drift, *Mathematical *Stream biota, *McLay model, Velocity, flow, Migration, Sampling.

The model of McLay (J. Fish. Res. Boa 27:359-370) for describing the drift of strea nisms was tested in a variety of field experi which organisms were disturbed from the s and/or the natural drift was blocked. In ea

appropriate corrections may be made of the of drift organisms by the sampling nets. rbed animals drifted at a rate much less than n velocity. The logarithm of the distance led was a linear function of the logarithm of stream velocity and conformed to the y model. Similarly, the model adequately bed experiments in which two disturbances done simultaneously, when drift was blocked -h period, and when there was both disturbnd blockage. A more comprehensive version model was only partially successful in deg the drift at various distances downstream lockage sustained for 4 d, probably because tream migration of organisms through the te, spatial differences in the densities of ani- the substrate, or a reduction in drift rate at density in the substrate. (Author's abstract) 0628

KLIST OF PHYTOPLANKTON (EXCLUOF DIATOMS) IN KENTUCKY RESER-

/ State Univ., KY. Dept. of Biological Sci-

Barnese, and J. M. King.
ctions of the Kentucky Academy of Sci-Vol. 46, No. 1/2, p 46-50, March, 1985. 1 Tab, 17 Ref.

ptors: *Phytoplankton, *Kentucky Reser-Tennessee River, *Population dynamics, Seasonal variation.

empt was made to identify the phytoplankcies which occur in the lower portion of ky Reservoir. Fourteen collection sites stablished between the Tennessee River 3.3 and 49,.0 on Kentucky Reservoir. Two re located in each of 2 embayments on the and eastern sides of the reservoir. Six sites tablished in the main portion of the reser- were situated upriver, between and downom the embayments. The study revealed cies, varieties and forms representing 59 The green algae dominated the algal flora asons but were most numerous in summer, en algae were most abundant in summer , while euglenoids reached their peak in . The number of dinoflagellates was relaw throughout the year. (Baker-IVI) 631

INOLOGY OF HARVEYS LAKE,
Coll., Wilkes-Barre, PA. Dept. of Biology.
ith, and C. B. Reif.
ings of the Pennsylvania Academy of Sci-ol. 58, No. 2, p 131-139, 1984. 3 Tab, 31

ors: *Harveys Lake, *Pennsylvania, *Bioy, *Plankton, Algae, Copepods, Cladocerifers, Zooplankton, Phytoplankton, Popuynamics, Diatoms, Cyanophyta, Chlorohyrrhophyta.

e of Harveys Lake have been studied very a lake of its age and size. It is the largest ake in Pennsylvania, with an area of 263 As a dimictic lake, Harveys Lake is well- during the summer periods. Oxygen con- in the hypolimnion was 4 ppm just e thermocline and less than 1 ppm in the part of the lake. Oxygen concentration e ice was reduced to less than 3 ppm just e spring breakup. Mean pH values show a d trend from 7.4 to 6.2 during the last cades. The lake demonstrated the annual algal successional pattern typical of temmictic lakes: diatom dominance in winter, yte abundance in summer and autumn, -green maxima in late summer. Diatoms esent throughout the year, with lowest in summer months. Two blue-green orgariously identified as Anabaena sp. and/or p., were present throughout the year, in umbers in the summer months but rare in er. In other algal groups, Peridinium in June and Dinobryon was present ut the year with peaks in March, May, ist. Euglenoids were rare, as was Mallomonas. The zooplankton community appeared to be typical of a lake population and consisted of different species in limnetic and littoral zones. Very few copepods were in the tows or in the squeezes during 1982-83, compared with the numbers observed in samples from Harveys Lake collected in previous years. Cladocerans and rotifers were most abundant with Bosmina and Chydorus present in all samples. (Baker-IVI)
W86-00633

ADDITIONS TO ICHTHYOFAUNA OF THE SUSQUEHANNA RIVER WITH A CHECKLIST OF FISHES OF THE SUSQUEHANNA RIVER DRAINAGE BELOW CONOWINGO DAM,
Radiation Management Corp., Drumore, PA.
Muddy Run Ecological Lab.
P. E. McKeown.
Proceedings of the Pennsylvania Academy of Science, Vol. 58, No. 2, p 187-192, 1984. 1 Fig, 1 Tab, 24 Ref.

Descriptors: *Conowingo Dam, *Maryland, *Susquehanna River, *Fish, Population dynamics, Hydroelectric plant, Migration, Distribution.

Conowingo Dam (Maryland) presently acts as an effective barrier to the upstream migration of fishes. Access to the upper Susquehanna River is limited to the transport of select species from the fish collection facility at the Dam. Accessibility of the lower Susquehanna River to upriver migration from the bay region, migration to and from Deer and Octoraro creeks and downriver passage through Conowingo Dam provide a theatre for a diverse fishery. A total of 103 species was recorded for the Susquehanna River Drainage in compiling the ichthyfaunal list. Seventy-two of these fishes are considered native to the River drainage. Of the total number recorded for the drainage, 78 were collected in the lower Susquehanna River during the study period. Fourteen are considered additions to the drainage and were not previously discovered there. (Baker-IVI)
W86-00635

FACTORS CONTROLLING MASS LOSS AND NITROGEN DYNAMICS OF PLANT LITTER DECAYING IN NORTHERN STREAMS,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 2K.
W86-00637

ALTERATION OF MICROBIAL METABOLIC ACTIVITIES IN ASSOCIATION WITH DETRITUS,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
For primary bibliographic entry see Field 2K.
W86-00639

ACCUMULATION OF SEDIMENT ORGANIC MATTER IN A HARDWATER LAKE WITH REFERENCE TO LAKE ONTOGENY,
University of Southern Mississippi, Hattiesburg. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2J.
W86-00643

FRESHWATER AQUACULTURE IN CHINA: ECOSYSTEM MANAGEMENT FOR SURVIVAL,
New Alchemy Inst., East Falmouth, MA.
R. D. Zweig.
Ambio, Vol. 14, No. 2, p 66-74, 1985. 10 Fig, 1 Tab, 26 Ref.

Descriptors: *Fisheries, *China (Peoples Republic), *Aquaculture, Ecosystems, Management, Water resources development, Fish ponds.

The demand for freshwater fish is high in China. The enormous population pressure upon available natural resources in general is perhaps the greatest present environmental concern. The long history of freshwater aquaculture development demonstrates how China's overall food production strategies have come to use intensely her inherent water resources, including ponds, natural lakes and reservoirs. Nonetheless, considerable room exists for expansion of, and improvement in, the overall efficiency of fisheries practices. Various approaches are suggested for lake fisheries, reservoir fisheries and pond fish culture. The matching of feeding habits of fish polyculture to the available nutrients is an important step. There are two pond-fish culture strategies which are most commonly followed in China - stocking and harvesting in rotation and multigrade conveyor culture. With the rotation method, three size classes of each species are stocked in food-fish ponds during February and March. Beginning in July and August and continuing through January, the harvest sized fish are seined from the pond and replaced with fingerlings. The multigrade conveyor method uses a series of ponds with fishes of specific size classes cultured in each pond and moved as they grow. From the last pond, generally the fifth in the sequence, market sized fish are harvested monthy. The latter method is most common in the south of China where year-round, high growth is possible. (Baker-IVI)
W86-00664

RELATIONS BETWEEN PHYTOPLANKTON AND ENVIRONMENTAL FACTORS IN A SMALL, SPRING-MEROMICTIC LAKE IN SOUTHERN FINLAND,
Helsinki Univ., Lammi (Finland). Lammi Biological Station.
L. Arvola, and M. Rask.
Aqua Fennica, Vol. 14, No. 2, p 129-138, 1984. 11 Fig, 1 Tab, 40 Ref.

Descriptors: *Phytoplankton, *Meromictic lakes, *Finland, Lakes, Temperature effects, Seasonal variation, Primary productivity, Zooplankton, Plankton, Nutrients, Stratification, Light intensity, Chlorophyll.

Factors controlling the phytoplankton community in the epilimnion of a steeply stratified lake with restricted turbulence mixing are demonstrated. The study lake, Alinen Mustajarvi, is a small oligomesohumic lake situated in the Evo district in southern Finland. The lake is a groundwater seepage lake, having no inlets and with a very small catchment area. Before ice break, chlorophyll a concentration increased as well as the proportion of small flagellates. A slight maximum of chlorophyll was noted about 2 weeks after the ice break. At the beginning of the thermal stratification algal succession was very rapid. Small Chlorococcales dominated in midsummer, chrysophytes later in summer and in autumn as well as cryptomonads and dinophytes. Generally, smaller species dominated in spring and during summer stratification and larger ones later in summer and in autumn. Factors determining the phytoplankton community seemed to be as follows: before ice break mainly light and temperature, after ice break temperature and nutrients, during summer stratification nutrients and zooplankton grazing, in autumn temperature and nutrients and during the autumn turnover light and temperature. The productivity of the study lake was rather high compared to the other Scandinavian lakes with small surface area and similar physicochemical conditions. Water color was one reason for this because in the study lake the euphotic zone was much deeper than in more colored brown water lakes. (Baker-IVI)
W86-00672

GENERAL LAKE WATER QUALITY INDEX,
National Board of Waters, Helsinki (Finland). Water Research Inst.
V. Malin.
Aqua Fennica, Vol. 14, No. 2, p 139-145, 1984, 7 Fig, 14 Ref.

Descriptors: *Lakes, *Water quality, *Pollution index, Measurement, Cluster analysis, Regression analysis.

A general lake water quality index was sought on the basis of data secured from a network of deepwater lakes during the years 1976-1981. By using

the principal component- and cluster analysis techniques, the variables to be included in the index were chosen from the measured variables. The original measurement data were transformed into quality values using so-called value functions in standard procedures which have been used earlier for the calculation of values of water quality indices. The basic idea behind the construction of the value functions for the general lake water quality index was to develop functions which could indicate how individual measurement results compare with the whole deepwater lake data. Cumulative relative frequencies of the variables of the data under examination were chosen as the basis for developing value functions. Regression analysis was used in developing the value functions used in the index. In most cases the index performed well. (Baker-IVI)
W86-00673

POTENTIALLY TOXIC BLUE-GREEN ALGAE (CYANOBACTERIA) IN FINNISH NATURAL WATERS,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5B.
W86-00674

FILLING IN THE GAP BETWEEN HYDROLOGY AND HYDROBIOLOGY - THE VIEWPOINT OF A HYDROLOGIST,
National Board of Waters, Helsinki (Finland). Water Research Inst.
E. Kuusisto.
Aqua Fennica, Vol. 14, No. 2, p 155-169, 1984. 9 Fig, 39 Ref.

Descriptors: *Morphometry, *Lakes, *Hydrology, Ice cover, Thermal conditions, Water balance, Limnology, Hydrodynamics, Mixing, Water currents.

Considerable progress has been made in recent years in the study of lake hydrodynamics. Hydrodynamic processes occurring in lakes are divided into the following groups: surface phenomena (wind generated waves, wind generated surface oscillations, and waves due to changes in discharge); internal currents (flow through the lake, and currents due to surface movements); and transport phenomena (mixing and stratification, and diffusion). All dynamic processes in a lake are characterized by spatial heterogeneity. This leads to incomplete mixing and uneven distribution of chemical and biological constituents within the water body. Simple mass balance relationships between the inputs of these constituents and their concentrations in water samples are usually not valid. Specific attention is given to wind induced currents, advective currents, convective currents, and dynamic biological limnology. Also discussed are morphometry, thermal conditions, ice and snow cover, and water balance. (Baker-IVI)
W86-00675

WATER QUALITY MODEL FOR LAKE KUORTANEENJARVI, A POLYHUMIC FINNISH LAKE,
Helsinki Univ. of Technology, Espoo (Finland). Dept. of Civil Engineering.
O. Varis.
Aqua Fennica, Vol. 14, No. 2, p 179-187, 1984. 7 Fig, 4 Tab, 11 Ref.

Descriptors: *Polyhumic lakes, *Finland, *Nutrients, *Simulation, *Algal growth, *Lake Kuortaneenjarvi, Eutrophication, Model studies, Phosphorus, Nitrogen, Algal blooms,.

A description is offered of nutrient dynamics and algal growth in a small northern polyhumic lake in terms of mathematical simulation. Lake Kurotaneenjarvi is located in the middle reaches of Lapuanjoki River. The area has a dense population and is rather poor in lakes. Recreational use of this lake is abundant. Slight eutrophication and blooms of blue green algae hinder fisheries and recreational users. Municipal waste waters cause about 5-10% of the total nutrient loading but in the summer this proportion rises to 30%. The application of the systems analysis approach in the modelling context proved helpful. Phosphorus and nitrogen cycles were simulated. Particular attention was given to simulation of blue green algae separately from other planktic algae. Lake Kurotaneenjarvi consists of two basins which both were simulated separately with identical lumped parameters models. The model was calibrated using observations from the upper basin and applied to the lower basin as a preliminary validation. The simulation results of calibrated state variables as regards to correctness with time as well as with level were relatively accurate. The model can be used in estimating the influence of changing nutrient loadings on the lake metabolism. Presumably, it cannot be directly applied to other lake ecosystems. (Baker-IVI)
W86-00677

NATURAL OCCURRENCE OF PIKE-PERCH (STIZOSTEDION LUCIOPERCA (L.)) AND SUCCESS OF INTRODUCTIONS IN RELATION TO WATER QUALITY AND LAKE AREA IN FINLAND,
Finnish Game and Fisheries Research Inst., Helsinki. Fisheries Div.
H. Lehtonen, T. Miina, and T. Frisk.
Aqua Fennica, Vol. 14, No. 2, p 189-196, 1984. 9 Fig, 2 Tab, 11 Ref.

Descriptors: *Lakes, *Finland, *Fish populations, *Pike-perch, Water quality, Limnology, Eutrophication, Phosphorus, Fisheries.

The relative abundance of pike-perch in lakes in Finland and the success of introductions of this species in relation to water quality and the lake area are described. The introductions of the fish are carried out with fry, fingerlings or larger fish with eyed ova. The success of these introductions depends on the quality of the lake and also on the quality and size of the fish used for stocking. Introductions in some areas have succeeded best when yearlings or two-year old pike-perch are used as stocking material. The higher the concentration of phosphorus in the lake, the more successful has been the introduction. In polyhumic lakes the results have often been poorer than elsewhere. Most introductions are carried out in small lakes the majority having a surface area of 3 sq km or less. About half of the introductions into small lakes were successful, whereas in large lakes with areas over 11.7 sq km only 22% of the introductions resulted in self-sustaining populations. It is not clear whether the result of introduction is primarily determined by the lake area or some other factor. It is possible that introductions are carried out more carefully in small than in large lakes because the fishing rights do not belong to so many people and the persons introducing the pike-perch can more often enjoy the results themselves. One reason for better results in small lakes may be that the large lakes suitable for the occurrence of pike-perch have mostly already had natural pike-perch stocks, whereas small lakes have not usually had pike-perch in their original fish fauna. (Baker-IVI)
W86-00678

IODINE CONTENT OF THE TISSUES OF THE VENDACE (COREGONUS ALBULA L.) IN CORRELATION TO THE IODINE CONTENT OF THE AMBIENT WATER,
Kuopio Univ. (Finland). Dept. of Applied Zoology.
E. Lahti, and O. Lindqvist.
Aqua Fennica, Vol. 14, No. 2, p 197-203, 1984. 8 Fig, 2 Tab, 23 Ref.

Descriptors: *Iodine, *Vendace, *Finland, *Fish physiology, Biological magnification, Brackish waters, Oligotrophic lakes, Fish food, Animal tissues, Animal physiology.

The iodine contents in the ambient water was correlated with iodine content in the vendace tissues, which also allows the calculation of the biomagnification factors of this element in the fish tissue. The material was collected in 1980 from the northern part of the Bothnian Bay (brackish water) and from inland lakes in Finland. All lakes represent the oligotrophic or dys-oligotrophic type. The thyroid contained the highest amount of iodir the muscle, the lowest. Little seasonal var was evident in the iodine content of the th Muscle and liver contents were lowest summer. Iodine levels in the ovary remained unchanged or increased slightly toward spawning period in the fall. Enrichment cients for iodine in the different tissues were ally higher in fish from lakes with low levels, and vice versa. The brackish water i est in iodine and the vendance tissues there tained the least amounts of the substance. The route for iodine into the vendace may be th its food, though during the lean seasons have to rely on its iodine stores in tissues. (I IVI)
W86-00679

GROWTH IN BIOMASS OF BALANUS LANOIDES YOUNG AT VARIOUS CURR VELOCITIES,
Akademiya Nauk SSSR, Moscow. Inst. of E tionary Morphology and Animal Ecology.
B. Y. Vilenkin, N. A. Pertsov, N. A. Plotniko and L. P. Tsygankova.
Doklady Biological Sciences, Vol. 278, No. 552-554, March, 1985. 1 Tab, 8 Ref.

Descriptors: *Barnacles, *Biomass, *Curre locity, Growth rates, Water currents, G stages, Growth kinetics.

The dependence of total biomass growth lanus balanoides young was shown to depe current velocity approximately according Rashevskii hypothesis on steady-state nutrit first applied by Monod with microorganism equation has the form $k = 0.0496 U/U +$ where k is the specific growth rate (per day) is the current velocity (cm/sec). The coeffic the numerator of this equation determine growth rate that is maximal for the give temperature, and experimental conditions, a pears to be a conservative indicator. The cient in the denominator is highly depende the food concentration in the flowing medium. The hyperbolic function best corres ing to the experimental data in the present resembles that long established for concent dependency of growth (or activity) of micro nisms. Values for the specific rate of bi growth during the observation of barnacle g on plates were obtained at four levels of c velocity at which repeatable results were obt The specific growth rate was calculated as k 1/32 (L/l), where l is the sum of shell diamet both plates at the start of the experiment, L same sum on day 32. The quantities obtained as follows: $U = 4.45$, $k = 0.0154$; $U = 8.9$ 0.0253; $U = 17.80$, $k = 0.297$; $U = 22.45$ 0.0353. Choice of the Rashevskii hypothes based on selection of the most significant regression obtained when these data were formed in various ways. (Rochester-IVI)
W86-00721

EFFECT OF VELOCITY OF WATER FLO GROWTH OF COLONIAL HYDROIDS DROZOA, THECAPHORA),
Moscow State Univ. (USSR).
N. N. Marfenin.
Doklady Biological Sciences, Vol. 278, No. 655-657, March, 1985. 1 Tab, 8 Ref.

Descriptors: *Hydrozoa, *Water currents, * ity, *Current velocity, *Animal growth, G rate, Feeding, Animal behavior.

Percentage increase in colony size of hy generally decreased as current velocity inc over the range 9-75 cm/sec, but there were ences among the four species tested. Obelia (Allm.) grew best at a flow velocity of 9 c At 31 cm/sec, a distinct decrease in grow was apparent, and at 51 and 75 cm/sec, the virtually no increase in colony size over 8 observation. O. longissima (Pall.) and O. gen (L.) colonies ceased to grow only at 75 c but O. longissima showed a marked change of increase in colony size at 51 cm/sec. Dyn

(L.) did not cease growth at any current
y, but growth was less at the highest and
velocities employed. Orientation of the
s of all species to the direction of water
id not affect their growth. The mechanism
n of current velocity on growth is linked to
behavior - anchoring, retaining, and ingest-
prey (Artemia nauplii) transported past the
h by the flow of water. When currents are
ul, pressing of axial shoots to the substrate
eral branches to the stalk makes feeding
or impossible. The species used here have
g degrees of stalk rigidity, with the shoots
veni being weakest and those of D. pumila
rongest. (Rochester-IVI)
722

ENT FLUXES IN EUTROPHIC COAST-
UISIANA FRESHWATER LAKE,
a State Univ., Baton Rouge. Center for
Resources.
ow, R. D. De Laune, and W. H. Patrick,

mental Management, Vol. 9, No. 3, p 243-
y, 1985. 12 Fig, 1 Tab, 19 Ref.

tors: *Nutrients, *Eutrophic lakes, *Louisi-
c des Allemands, Carbon, Nitrogen, Phos-
Sedimentation rates, Runoff, Cyanophyta,
uality, Water pollution sources.

and phosphorus cycling in a eutrophic
a freshwater lake system (Lac des Alle-
vas studied. Nutrients from runoff entering
as well as sediment-interstitial and lake
itrogen and phosphorus fractions, were
seasonally. Sedimentation rates in the
e determined using Cs-137 dating. Phos-
evels in the lake were found to be largely
nt on concentrations in the incoming
ater from upland drainage. Lake water
ations appear to respond to fluctuations in
waters. Laboratory equilibrium studies
bottom sediments in the lake are a major
the incoming dissolved orthophosphate
us. Total nitrogen concentrations in the
er generally exceeded incoming runoff
ations, suggesting fixation by the large
n algae population in the lake as being the
urce of nitrogen to the system. Sedimenta-
ed from 0.44 cm/year to 0.81 cm/year,
g on the proximity to the inlet bayous.
ough the lake is eutrophic the sediment
a buffer by removing large amounts of
itrogen, and phosphorus through sedi-
processes. Carbon, nitrogen, and phos-
ere accumulating in the sediment at rates
, and 1.1 g/sq m/year, respectively. The
ality of the lake is likely to continue to
less measures are taken to reduce munic-
strial, and agricultural inputs of phospho-
e lake. (Author's abstract)
4

METAL CONCENTRATIONS IN SEDI-
FROM TWO CLOSED-BASIN LAKES.
TICA,
mpshire Univ., Durham. Dept. of Earth

ns, P. A. Mayewski, and F. H.
n, Jr.
Geology, Vol. 48, No. 1/4, p 265-270,
985. 2 Fig, 1 Tab, 32 Ref. NSF grant
755.

rs: *Antarctic, *Trace metals, *Lake
Polar regions, Iron, Manganese,
Lead, Zinc, Water pollution sources,
ater, Calcium chloride, Brines, Don Juan
a Sisters Lake.

trace-metal data were collected from
d-basin lakes in Antarctica where no
anism disturbance of the historic record
place due to the harsh environment. Don
is located in the western end of one of
ice-free valleys, in southern Victoria
a Sisters Lake is an internally drained
y located in an ice-free portion at the
n end of the Morozimi Range. Sediment
ere analyzed for 25% HCl leachable Fe,
Mn, Cu, Pb, Zn. The data were normalized to 100% silt-clay. The Pb concentrations in the sediment of Don Juan Pond were extremely low, indicating Pb remobilization from these sediments by CaCl2-rich brines. This process may have a profound effect on the evolution of groundwater in the ice-free valleys of Antarctica. A possible surficial enrichment of Pb was observed in Shea Sisters Lake samples from northern Victoria Land. This suggests that this area of Antarctica may have been affected by worldwide fossil fuel burning. (Moore-IVI)
W86-00770

CHEMICAL COMPOSITION OF RIVER SEDIMENTS FROM THE INDIAN SUB-CONTINENT,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2J.
W86-00771

MATHEMATICAL MODEL FOR ANALYSIS OF SEDIMENT CORE DATA: IMPLICATIONS FOR ENRICHMENT FACTOR CALCULATIONS AND TRACE-METAL TRANSPORT MECHANISMS,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 5B.
W86-00772

USE OF SEEPAGE METERS TO ESTIMATE GROUNDWATER NUTRIENT LOADING TO LAKES,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 7B.
W86-00788

BOTTOMLAND VEGETATION DISTRIBUTION ALONG PASSAGE CREEK, VIRGINIA, IN RELATION TO FLUVIAL LANDFORMS,
Geological Survey, Reston, VA.
C. R. Hupp, and W. R. Osterkamp.
Ecology, Vol. 66, No. 3, p 670-681, June, 1985. 6 Fig, 4 Tab, 59 ref.

Descriptors: *Passage Creek, *Virginia, *Terrain analysis, *Vegetation, *Bottomlands, Channel morphology, Statistical analysis, Floodplains, Flooding, Riparian vegetation.

Persistent distribution patterns of woody vegetation within the bottomland forest of Passage Creek, Virginia, were related to fluvial landforms, channel geometry, streamflow characteristics, and sediment-size characteristics. Vegetation patterns were determined from species presence as observed in transects and traverses on landforms developed along the stream. Distinct species distributional patterns were found on four common fluvial geomorphic landforms: depositional bar, active-channel shelf, floodplain, and terrace. Independent hydrologic characteristics (flow duration and flood frequency) were determined for each of the landforms. Vegetation data were analyzed by binary discriminant analysis, principal components analysis, and detrended correspondence analysis. Results and related field observations suggest that certain species are significantly associated with specific fluvial landforms. Vegetation patterns appear to develop more as a result of hydrologic processes associated with each fluvial landform rather than from sediment-size characteristics. Flood disturbance may be an important factor in maintaining the vegetation patterns, which may therefore be used as indicators for particular hydrogeomorphic site conditions. (Author's abstract)
W86-00826

HISTORICAL CHANGES IN SUBMERGED MACROPHYTE COMMUNITIES OF UPPER CHESAPEAKE BAY,
California Univ., Santa Barbara. Dept. of Geography.
F. W. Davis.
Ecology, Vol. 66, No. 3, p 981-993, June, 1985. 7 Fig, 5 Tab, 65 Ref.

Descriptors: *Aquatic plants, *Chesapeake Bay, *Seeds, *Sediment cores, *History, Eutrophication, Water pollution effects, Macrophytes, Aquatic weeds, Elodea, Land use, Vallisneria, Najas, Myriophyllum.

Submerged macrophyte species that occurred at the head of Chesapeake Bay over the past 1800 yr have been documented by analyzing seed assemblages in sediments from a tidal embayment. To help interpret seed stratigraphy in the estuary, seed settling behavior was studied in the laboratory, and the relationship between parent vegetation and resulting sedimentary seed assemblages was studied in a tidal creek. Results suggest that estuarine seed assemblages are primarily locally derived and have high spatial variability, and that because of differences in seed output or preservation some species are overrepresented in the seed record. Seed assemblages in four cores from the estuary are accordingly treated as presence/absence data. The record of local submerged macrophytes was profiled in 7-100 yr intervals, using sediment dates obtained radiometrically and by pollen stratigraphy. Vallisneria americana, Najas flexilis, N. gracillima, and Elodea canadensis were consistently present for 1500-1600 yr prior to colonization by Europeans (1730 AD), while N. guadelupensis appeared 300-400 yr prior to European settlement. Vallisneria americana was the only local species continuously present for 150 yr following initial deforestation. After 1930, N. guadalupensis and N. flexilis appeared more regularly in the record, and two local expansions of Myriophyllum spicatum were registered. Native submerged aquatic vegetation disappeared from the area between 1964 and 1972, and has shown little recovery since that time. Community changes after 1930 appear to be related to increased eutrophication. (Author's abstract)
W86-00828

RELATIONSHIPS BETWEEN SURFACE SEDIMENT DIATOM ASSEMBLAGES AND LAKEWATER CHARACTERISTICS IN ADIRONDACK LAKES,
Indiana Univ. at Bloomington. Dept. of Biology.
D. F. Charles.
Ecology, Vol. 66, No. 3, p 994-1011, June, 1985. 11 Fig, 5 Tab, 71 Ref. NSF grant DEB 77-03907 and DEB 79-12210.

Descriptors: *Lake sediments, *Diatoms, *Adirondack Mountains, *New York, *Water quality, *Species composition, Hydrogen ion concentration, Acid lakes, Ecological effects, Mountain lakes, Elevation, Water temperature, Sulfuric acid, Chlorine, Silicone, Phosphorus, Chlorophyll a, Acidity.

Relationships between surface sediment diatom assemblages and lakewater characteristics were studied in 38 lakes in the Adirondack Mountains of northern New York. Most of the lakes are dilute, poorly buffered, and oligotrophic to mesotrophic. The diatom flora (240 taxa identified) is typical for circumneutral to acidic lakes. The purposes of this study were to identify the environmental factors most strongly related to the distributions of diatom taxa and the overall composition of diatom assemblages, and to derive equations to infer lakewater pH from diatom assemblage data. Relationships between diatom assemblages and environmental gradients were analyzed using reciprocal averaging ordination (RA). Correlations between RA axis 1 and pH-related factors were strong (pH, r squared = 0.90; alkalinity, r squared = 0.81; p(Ca positive charges), r squared = 0.67; pMg, r squared = 0.78; pNa, r squared = 0.48; p-total Al, r squared = 0.58; conductivity, r squared = 0.47). Correlations were weaker (but still statistically significant) with elevation, epilimnion temperature, and concentrations of SO4, Cl, and Si. Total P, chlorophyll a, water color, and mean depth were not important in explaining differences among assemblages. Cluster analysis of lakes and diatom taxa, multiple regression of taxon cluster groups with lakewater pH, and the occurrence patterns of individual taxa also indicated that pH-related factors are closely associated with diatom distribu-

tions. Euplanktonic taxa were present only rarely in surface sediments of lakes having a pH < 5.8, alkalinity < 20 micro-mol/L, and concentrations of Ca positive charges < 100 micro-mol/L and total Al > 60 micro-g/L. Predictive equations were derived for inferring lakewater pH from diatom assemblage data. Most were based on approaches of Hustedt (1939), Nygaard (1956), Merilainen (1967), and Renberg and Hellberg (1982). Agreement between predicted and measured pH was very good; r squared values ranges from 0.61 to 0.94 and SE from 0.28 to 0.60 pH units. These predictive relationships can be used to interpret stratigraphic diatom assemblages to reconstruct lake pH histories. No significant relationships existed between Araphidinae:Centrales ratios and measures of trophic status. (Author's abstract)
W86-00829

PHOSPHORUS SPIRALLING IN A WOODLAND STREAM: SEASONAL VARIATIONS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
P. J. Mulholland, J. D. Newbold, J. W. Elwood, L. A. Ferren, and J. R. Webster.
Ecology, Vol. 66, No. 3, p 1012-1023, June, 1985. 4 Fig, 5 Tab, 43 Ref. U.S. DOE contract DE-AC05-840R21400.

Descriptors: *Nutrient spiralling, *Phosphorus radioisotopes, *Cycling nutrients, *Seasonal variation, *Walker Branch, *Tennessee, Radioisotopes, Spiralling length, Particulates, Organic matter.

Four radiotracer releases were performed over an annual period in 1981-1982 to determine seasonal variation in indices and pathways of phosphorus spiralling in Walker Branch, a small woodland stream in eastern Tennessee, USA. Each release consisted of an addition of approximately 370 MBq each of carrier-free labeled PO4 and labeled H2O over a 1-h period during baseflow. Concentrations of P-32 and H-3 dissolved in stream water were measured intensively at several stations downstream from the radiotracer input during and immediately following each release. Activity of P-32 in coarse particulate organic matter (CPOM), fine particulate organic matter (FPOM), and aufwuchs was measured 2-3 h after each release and at various intervals for 7 wk. Total biomass of CPOM, FPOM, and aufwuchs at the time of each release was also measured. Uptake of labeled PO4 from the water was greatest in November and lowest in August. Uptake length (Sw) of phosphorus, defined as the average distance travelled by a PO4 ion dissolved in water, varied from 22 m in November to 97 m in August. Uptake of PO4 by CPOM was generally greatest, with approximately 50% of total uptake, while that by aufwuchs was lowest, with < 15% of the total. CPOM abundance was the major determinant of whole-stream PO4 uptake rate and Sw. Turnover length (Sp) of phosphorus, defined as the average distance traveled by an atom of P taken up by particulate material, was short compared to Sw varying from 1 m in November to 3 m in January. Consequently total spiralling length (S) of P varied from 23 m November, just after peak autumn leaf fall, to 99 m in August, and reflected primarily the travel of P in the dissolved form. Our results indicate that the greatest increase in Sw (and consequently in S) in Walker Branch occurs in late autumn or winter after storms reduce the abundance of CPOM in the lower portions of the stream bed. Although we calculate that Sp may increase by one to two orders of magnitude for short periods during storms, the greatest effect of storms on P spiralling over the long term is their impact on the quality and quantity of CPOM and FPOM in the stream bed after the return to baseflow. For most of the year, detrital organic carbon probably influences phosphorus spiralling more than phosphorus spiralling influences the processing of organic carbon in Walker Branch. Only during the fall and early winter periods, when CPOM abundance is high and Sw is short, does phosphorus spiralling exert strong control over biotic processes downstream. (Author's abstract)
W86-00830

NITROGEN TRANSFORMATIONS AND LOSS IN FLOODED SOILS AND SEDIMENTS,
Agricultural Research and Education Center, Sanford, FL.
For primary bibliographic entry see Field 2K.
W86-00849

LAKE MODELING: STATE OF THE ART,
R. H. French.
CRC Critical Reviews in Environmental Control, Vol. 13, No. 4, p 311-357. 6 Fig, 10 Tab, 146 Ref.

Descriptors: *Lake modeling, *Limnology, *Reservoirs, *Model studies, Hydrodynamics, Cycling nutrients, Phosphorus, Steady-state models, Nitrogen, Limiting nutrients.

Modeling of hydrodynamics and chemical and biological processes in surface water impoundments (ie, natural lakes and man-made reservoirs) is reviewed. Basic concepts of one-, two-, and three-dimensional hydrodynamic models are available now that they are conceptually correct, numerically efficient, reasonably accurate when used correctly, and relatively well documented. Research models typically incorporate the most modern methods, but have inadequate documentation and have not been sufficiently tested. Applied models may not employ state-of-the-art methods, but are well documented and have been comprehensively tested. The latter are to be preferred. Impoundment modeling is further advanced in the area of hydrodynamics than in the areas of chemical and biological processes. Additional research is needed regarding the linkage among hydrodynamic, chemical, and biological processes. The flux of nutrients across the sediment interface cannot be accurately simulated without site-specific studies. Steady-state loading and biomass models, when properly employed, can provide cost-effective results which complement the results that can be obtained from dynamic water quality models. These two types of models should be used together in design of impoundment restoration programs. The limits of coefficient validity in steady-state models need to be further denied. Although most impoundments studied to date appear to have been phosphorus-limited, there exist a significant number of nitrogen-limited impoundments. (Rochester-IVI)
W86-00850

SOME MIRE SYSTEMS IN JAPAN,
Aberdeen Univ. (Scotland). Dept. of Botany.
C. H. Gimingham.
Transactions of the Botanical Society of Edinburgh, Vol. 44, No. 3, p 169-176, 1984. 1 Fig, 2 Ref.

Descriptors: *Japan, *Mires, *Peat bogs, *Wetlands, Ecosystems, Vegetation, Habitats, Conservation.

Some examples of different types of mires in Japan are described and compared with their European counterparts. The parallels in ecosystem development and vegetation physiognomy with mires in equivalent habitats in Europe are striking. Numerous species are common to both, in other cases closely related species fill similar niches. In some instances, however, a given species displays marked ecological differences in the two regions. The flood plain mires of Hokkaido and the mires of Oze and Kirigamine are among the finest examples of their kind in the world. Those in the mountain districts are adequately protected in National Parks: it is suggested that the lowland mires of Hokkaido require further protection. (Author's abstract)
W86-00904

LIMNOLOGY AND MACROPHYTE VEGETATION OF A DEEP, CLEAR LIMESTONE LAKE, LOCH BORRALIE,
Saint Andrews Univ. (Scotland). Dept. of Plant Biology and Ecology.
D. H. N. Spence, A. M. Barclay, and E. D. Allen.
Transactions of the Botanical Society of Edinburgh, Vol. 44, No. 3, p 187-204, 1984. 4 Fig, 3 Tab, 26 Ref.

Descriptors: *Loch Borralie, *Scotland, *Limnology, *Macrophytes, Nutrients, Interstitial water, Aquatic plants, Lakes, Limestone lakes.

A bathymetric survey shows Loch Borralie (land) to have a maximum depth of 36 m. It of the most transparent lakes in Britain unstratified and poor in nutrients and phyto ton, although the interstitial water of its calc muds is rich in nitrogen and phosphorus. four percent of the loch surface is densely nized by macrophytes. The littoral to 2 m very sparse Chara aspera var. lacustris a zone from 2 to 4.5 m is dominated by tall H vulgaris, Myriophyllum spicatum and four mogeton spp., for which Chara and Nitella pally C. globularis and N. flexilis) form an storey. Three Potamogeton species persist t in an undulating Chara-Nitella 'meadow' continues, alone, to between 12 and 15 m Loch Borralie is the most deeply and possi most extensively colonized lake in the Kingdom. (Author's abstract)
W86-00905

AQUATIC ANGIOSPERM COMMUN FROM LOCHS ON RHUM,
Saint Andrews Univ. (Scotland). Dept. of
A. M. Farmer.
Transactions of the Botanical Society of burgh, Vol. 44, No. 3, p 229-236, 1984. 1 Tab, 15 Ref.

Descriptors: *Lochs, *Aquatic plants, * phytes, *Rhum, *Scotland, Lakes, Ponds, L Exposure, Substrate.

The aquatic angiosperm communities from lochs and lochans on the island of Rhum N Nature Reserve (Scotland) were surveye sites are mostly located around the major l the central part of Rhum, but a small nu more widely distributed lochs are also incl that local differences in vegetation may be Species lists are given for each site. The ve in the study sites is comparable to those of lochs surveyed in other parts of Western S Aquatic vegetational cover is sparse and limited number of plant communities are predominantly those involving Lobelia do and Littorella uniflora as dominants or co ants, and a more restricted representation munities with Equisetum fluviatile, Phr australis or Nymphaea alba subsp. alba. E and poor substratum are suggested as facto ing limited plant growth. The littoral z many lochs are strewn with large rocks, w only restrict plant growth but create furthe lence. Only in a few of the larger loch sheltered bays and deeper water, are there plant communties. (Moore-IVI)
W86-00906

DYNAMICS OF THE STRUCTURE O ICHTHYOCENOSIS OF LAKE UBINSK
R. I. Setsko, and L. I. Tereshchenko.
Journal of Ichthyology, Vol. 24, No. 5, 1984. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Ichthyocenosis, *Lake Ub *USSR, *Lake fisheries, Fisheries, Fish tions, Fish harvest, Population dynamics level, Species composition.

The factors controlling the structure of th yocenosis of Lake Ubinskoye, western (USSR) were analyzed based on records levels and commercial catches from 19 original data, and published results. Lak koye has a surface area of 50,000 hectares average depth of 2.14 m, so that slight fluc in lake level produce considerable change and volumes of the lake. During the past 4 the ichthyocenosis of the lake has been ex ing intensified pressure from external in changes in lake level and exploitation un changing lake level regime, exploitati sudden appearance of the acclimatized bre 1952, and since 1968, changes in lake level exploitation, winter kill, introduction of pe reacclimatization of bream after winter ki trends in qualitative transformation of the cenosis are apparent: (1) change in the nu basic (commercial) species, which are cl

the complexity index (H sub m = log base
here n = the number of species in the
cial catch), (2) replacement of some basic
by others, without any change in the over-
, which is characterized by the index for
ee of species similarity (a modification of
nsen index, K = c/a x 100%, where c =
ber of species common to two lists being
d and a = the number of species in one of
of interest), and (3) redistribution of the
n the overall biomass, a parameter indicat-
e 'entropy' (H = sum of p sub i log base 2
where p sub i is the share of the species in
ral biomass) and 'relative organization' (R
/H sub m). The redistribution of stock of
species into the general biomass is a con-
ctive mechanism regulating the structure
hthyocenosis; only when regulation at this
omes no longer possible do mechanisms of
l changeovers come into play. (Rochester-

12

IC MATTER IN GRAVEL STREAMS
CT RITRODAT-LUNZ),
l Station, Lunz am See (Austria).
tfried.
lung Internationale Vereinigung Limnolo-
22, No. 4, p 2058-2062, 1985. 9 Fig, 13

ors: *Benthos, *Organic matter, *Gravel
*Particle size, Bacteria, Fungi, Particulate
tream sediments, Sediments.

streams in mountainous areas, the energy
nearly exclusively allochthonous organic
mainly particulate organic matter (POM)
erosion and aerial drift. The main energy
connects POM over the microbenthos
d bacteria) with the so-called detritivor-
ls (more appropriately called pomivorous
Pomivorous animals prefer particles colo-
fungi and bacteria as food. This study
tes on bed sediments, and their surfaces
or colonization by bacteria and fungi. The
ercentage of sediment grains smaller than
creases with sediment depth, but rarely
0%. POM concentrations decrease rapid-
creasing grain size. POM concentrations
s high in the grain size-class 0.5 to 1 mm,
is size class most valuable for pomivor-
ls. In any stream-ecosystem analysis, the
bed sediment-surface suitable for coloni-
the microbenthos ia a main parameter,
overlooked. (Moore-IVI)
3

OF DROUGHTS ON THE INVERTE-
COMMUNITIES OF HIGH MOUN-
REAMS,
ademy of Sciences, Krakow. Zaklad Bio-
cki.
ng Internationale Vereinigung Limnolo-
2, No. 4, p 2069-2072, 1985. 5 Fig, 1 Ref.

rs: *Invertebrates, *Droughts, *Poland,
variation, Streams, Stream biota, May-

the invertebrate fauna of the high moun-
n Sucha Woda (High Tatra Mountains,
dicate that droughts or winter freezing
ant causes behind the development of a
una in the kryon zone. Two stations
led: station 1, at 1,600 m, was below the
f Lake Czarny Staw Gasienicowy, and
flowing for 5-7 mo following the begin-
ow melt (May, June) and station 2, at
ltitude, was below the sector of the
stream, and had water flowing from the
ow melt until August in dry years or
eginning of winter in wet years. When
s begin to flow, two periods of faunal
nt can be distinguished. In the first
ochthonous elements, adapted to surviv-
t, dominate (Prosimulium and Diamesa
t station 1 and Eukiefferiella cyanea
ametriocnemus borealpinus (pool) at sta-
the second period, the dominant ele-
ments are those that migrate from other places either by downstream drift (station 2 only) or aerially (both stations). In the summer drift, mayflies (Baetis alpinus) are most important. In a temporary stream situated below a sector of permanent stream, the fauna adapted to life in temporary streams exists only for a relatively short period, and is soon replaced by a fauna typical of permanent streams whose representatives are better adapted to living in the stream. On the other hand, at higher altitudes, the opportunity is much smaller for the fauna of permanent streams to inhabit a given reach of stream, and occurs, though not always, by the end of the growing season. Thus, species characteristic of temporary streams remain for most or all of the season. (Rochester-IVI)
W86-00915

CHEMICAL-PHYSICAL CHANGES ASSOCIATED WITH ENVIRONMENTAL GRADIENTS IN THE OKA RIVER BASIN,
E. Orive, and I. Arteaga.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2073-2076, 1985. 3 Fig, 5 Ref.

Descriptors: *Oka River basin, *Spain, *Physicochemical characteristics, *Environmental gradient, *Biotic index, Geochemistry, Water temperature, Conductivity, Alkalinity, Hydrogen ion concentration, Oxygen, Nutrients, Phosphates, Nitrates, Nitrites, Chloride, Benthos, Macroinvertebrates, Cluster analysis, Principle components analysis, Statistical analysis.

Physical and chemical parameters and biotic index (Tuffery and Verneaux) data, when subjected to multivariate analyses, defined differences among sampling sites in the Oka River basin (North Spain) that appeared to be related principally to geologic substrate and distance from the headwaters. At each of 124 stations, temperature, conductivity, alkalinity, pH, oxygen, nutrients (phosphate, nitrate, and nitrite), and chloride were measured and benthic macroinvertebrates were collected. Longitudinal trends of the main variables were examined by principal components analysis and cluster analysis. The influences of sewage effluents, chloride from sea spray, and changes in conductivity resulting from the change from non-calcareous (basalt and sandstone) to calcareous (principally chalk) substrates were apparent in the data. The biotic index indicated environmental stress in the lower reaches of the basin. Cluster analysis separated the stations into groups among which the differences were determined mainly by their distance from sea level. (Rochester-IVI)
W86-00916

PATTERNS OF MACROINVERTEBRATE DISTRIBUTION IN THE LLOBREGAT RIVER BASIN (NE SPAIN),
Barcelona Univ. (Spain). Dept. de Ecologia.
G. Gonzalez, X. Millet, N. Prat, and M. A. Puig.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2081-2086, 1985. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Macroinvertebrates, *Spatial distribution, *Species composition, *Llobregat River Basin, *Spain, Streams, Rivers, Ecological distribution, Aquatic insects, Water pollution effects.

Patterns of macroinvertebrate (mainly insect) distributions in the Llobregat River drainage (northeastern Spain) showed that there were five groups (mountain stream species, stream species, small stream species, riverine species, and special distributions). Sampling was conducted at 74 sites, which were visited in September and December 1979 and April and August 1980. The mountain species group had a reduced distribution, with high percentage abundances in the upper reaches. The stream species group had a distribution throughout the entire upper basin, with the highest percentage values in the Llobregat main channel. The small stream group was distributed in all the lateral small channels of the basin, with the highest percentage values in the small streams; the only difference separating this group from the stream species was the lower order of streams it occupied. The riverine species had the widest distribution observed, and were found either in lateral small streams or in the main channel, although the highest percentage values were found in the lower reaches of the main channel. Special distributions included some species that did not fit the other patterns. These included species that appeared to be restricted due to salinity, occurrence in springs, or for no apparent reason. Generally, the five groups showed successively greater overlap proceeding from the restricted distribution of the upper reaches toward the wider distributions of the lower zones. This reflects increasing uniformity of habitat in the downstream direction, which is produced by the hierarchical structure of the river basin and the pollution of the main channel. (Rochester-IVI)
W86-00917

VARIATIONS IN THE AMOUNT OF ORGANIC CARBON (DISSOLVED AND PARTICULATE) IN A SMALL MEDITERRANEAN MOUNTAIN STREAM (CORSICA) (LES VARIATIONS DES TENEURS EN CARBONE ORGANIQUE (DISSOUS ET PARTICULAIRE) D'UN PETIT TORRENT MEDITERRANEEN MONTAGNARD (CORSE)),
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
M.-D. Loye-Pilot.
Verhandlung Internationale Vereinigung Limnology, Vol. 22, No. 4, p 2087-2093, 1985. 1 Tab, 10 Ref.

Descriptors: *Organic carbon, *Mountain streams, *Dissolved solids, *Particulate matter, *Corsica, *France, Flow discharge, Storms, Streams, Throughfall, Soil water, Forest watersheds, Soil erosion.

Dissolved and particulate (< 1 mm) organic carbon was measured during 2 years in a small mountain stream in a pristine forested mediterranean area (Corsica). The dissolved organic carbon (DOC) values range from 0.5 to 8.1 mg/l, those of the particulate organic carbon (POC) from 0.09 to 10.3 mg/l. The DOC/POC ratio fluctuates from 0.3 to 28, but generally DOC is far greater than POC. There is no correlation between DOC, POC, TOC (total organic carbon) and water discharge, but each storm event presents a DOC and POC increase with discharge, with various patterns of DOC, POC at discharge peaks. DOC during low-flow stage in summer and in-between storm events is close to the groundwater values (0.4-0.5 mg/l). DOC increases when throughfall and/or soil water reach the stream channel. The POC peak appears just before or during the rising limb of the hydrograph, or at the discharge peak. POC peak duration is generally very short; thus peak sampling is necessary for export computing. The removal rate of the POC stored in the channel and the soil erosion rate determine the export pattern of POC. DOC and POC variations depend on the storm events and, for each storm, on the recent hydroclimatic 'history' of the watershed. (Author's abstract)
W86-00918

ABIOTIC AND HYDROBIOLOGIC CHARACTERISTICS OF THE MEDITERRANEAN RUNNING WATERS (CARACTERISTIQUES ABIOTIQUES AND HYDROBIOLOGIQUES DES EAUX COURANTES MEDITERRANEENNES),
Aix-Marseille-3 Univ. (France). Faculte des Sciences et Techniques.
J. Giudicelli, M. Dakki, and A. Dia.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, Part 4, p 2094-2101, March, 1985. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Hydrology, *Lotic environment, *Mediterranean basin, *Aquatic animals, Running waters, Hydrobiology, Climate, Altitude, Precipitation, Distribution, Water temperature, Ecosystems.

The permanent Mediterranean watercourses have a regime characterized by irregularity of flow and by extreme hydrologic conditions. Precipitation is concentrated in short periods. Variations in thermal regime are also extreme. Studies were con-

ducted on four river systems in different parts of the Mediterranean basin to determine the principal characteristics of Mediterranean lotic ecosystems. The fauna is rich in endemics and is composed of a number of autochthonous lines which are unique to the ecosystems. The biocenotic analysis indicates that there is a notable longitudinal zonation; the zonation is generally compressed. In the eastern Mediterranean islands, there is no longitudinal zonation due to the low output of the streams. Both thermal and altitudinal influences are evident. (Moore-IVI)
W86-00919

2I. Water In Plants

SEASONAL AND DIURNAL WATER RELATIONS ADJUSTMENTS IN THREE EVERGREEN CHAPARRAL SHRUBS,
San Diego State Univ., CA. Systems Ecology Research Group.
W. D. Bowman, and S. W. Roberts.
Ecology, Vol. 66, No. 3, p 738-742, June, 1985. 3 Fig, 25 Ref. NSF grant DEB 80-25977.

Descriptors: *Seasonal variation, *Chaparral, *Diurnal distribution, *Plant water potential, Water potentials, Oak, Bearberry, Ceanothus, Pressure-volume approach, Turgidity, Water stress.

Pressure-volume curves were measured in three co-occurring chaparral shrubs, Arctostaphylos glandulosa, Quercus dumosa, and Ceanothus greggii, during a seasonal drought cycle. The pressure-volume approach was used to quantify diurnal and seasonal changes in plant water relations. Field measurements of plant water potentials and microclimate were also made to relate the pressure-volume results to the field setting. The seasonal trend was toward increasingly negative osmotic potentials with little (Q. dumosa) or no (A. glandulosa and C. greggii) recovery following the end of the drought. Shifts in the turgor loss point occurred both seasonally and diurnally. The larges diurnal shifts occurred during periods of maximum air temperature and minimum soil water potential. Concurrent field measurements of water potential indicate that these shifts were necessary for preventing turgor loss during periods of midday water stress in Q. dumosa and C. greggii. The shrubs differed in their mode of seasonal osmotic adjustment. Ceanothus greggii accomplished changes in osmotic potential by variation in the osmotic water volume; the other two shrubs appeared to accomplish such changes largely by solute variation while maintaining relatively constant osmotic water volumes. (Author's abstract)
W86-00827

EFFECT OF FLOODING OF SOIL ON GROWTH AND SUBSEQUENT RESPONSES OF TAXODIUM DISTICHUM SEEDLINGS TO SO2,
Wisconsin Univ.-Madison. Dept. of Forestry.
For primary bibliographic entry see Field 5C.
W86-00861

EFFECT OF DROUGHT ON METABOLISM AND PARTITIONING OF CARBON IN TWO WHEAT VARIETIES DIFFERING IN DROUGHT-TOLERANCE,
Melbourne Univ., Parkville (Australia). Plant Sciences Section.
M. E. Nicolas, H. Lambers, R. J. Simpson, and M. J. Dalling.
Annals of Botany, Vol. 55, No. 5, p 727-742, May, 1985. 8 Fig, 4 Tab, 24 Ref.

Descriptors: *Drought resistance, *Partitioning, *Metabolism, *Carbon, *Wheat, Moisture deficiency, Drought, Plant physiology, Crop yield, Roots, Leaves, Osmotic pressure.

A model was constructed to describe the partitioning of carbon on the third and seventh day from anthesis for well-watered and droughted plants of two wheat varieties (Triticum aestivum L. cv. Warigal and Condor). The glasshouse-grown plants were detillered so that a simplified model could be derived for the main stem. The 9-d drought treatment, imposed just after anthesis during the period of cell division in the grains, reduced grain yield by 18% in Warigal and 30% in Condor. Net carbon fixation was up to 60% higher in Warigal than Condor towards the end of the drought period and this correlated with better osmotic adjustment in the flag leaf. Carbon partitioning between plant organs responded to water deficit more rapidly than net carbon fixation. On day 3, carbon allocation of the roots of droughted plants was maintained in Condor and increased by 14% in Warigal, whereas carbon allocation to the ear decreased in both varieties. However the roots did not compete well with the ear when the water deficit became more severe. Warigal accumulated 3 times more stem reserves that Condor under drought. In the roots, the pattern of carbon allocation between respiration and carbon accumulation changed soon after imposition of drought. Although total root respiration decreased under drought it became more energy efficient, particularly for Warigal, as less respiration took place via the alternative pathway. On day 3, the larger carbon allocation to the roots and the lower root respiration accounted for the 4-times larger sugar accumulation in droughted roots of Warigal compared with those of Condor. Osmotic adjustment in mature leaves and roots may be of importance for the maintenance of vital processes and for recovery after drought. (Author's abstract)
W86-00907

EFFECTS OF DROUGHT ON PARTITIONING OF NITROGEN IN TWO WHEAT VARIETIES DIFFERING IN DROUGHT-TOLERANCE,
Melbourne Univ., Parkville (Australia). Plant Sciences Section.
M. E. Nicolas, R. J. Simpson, H. Lambers, and M. D. Dalling.
Annals of Botany, Vol. 55, No. 5, p 743-754, May, 1985. 3 Fig, 3 Tab, 13 Ref.

Descriptors: *Drought tolerance, *Nitrogen, *Partitioning, *Wheat, Moisture deficiency, Crop yield, Leaves, Stem, Roots, Translocation.

A model was constructed to describe the translocation and partitioning of nitrogen on the seventh day after anthesis for well-watered and droughted plants of two wheat varieties (Triticum aestivum L. cv. Warigal and Condor). The glasshouse-grown plants were detillered so that a simplified model could be derived for the main stem. A 9-d drought treatment was imposed just after anthesis and this coincided with the period of endosperm cell division in the grains. Warigal, which had a higher grain yield than Condor under drought, absorbed up to 15-times more nitrogen and translocated 1.5-fold more nitrogen to the shoot via the xylem. In both varieties, nitrogen redistributed from vegetative organs accounted for more than 60% in control and 70% in droughted plants of the nitrogen needed for ear growth. The net loss of nitrogen increased by 4.3% in the leaves, but decreased by 60% in the stem under drought. Stem and roots appeared to play an important role in the nitrogen economy of droughted plants: less nitrogen was translocated directly to the grains from the senescing leaves and 40-60% more nitrogen was translocated to the roots. Nearly all the nitrogen reaching the roots in the phloem was reloaded into the xylem stream and translocated back to the shoot. The transfer of nitrogen through the stem was reduced under drought and this resulted in a constant C:N ratio of the grains which may be important in the regulation of endosperm cell division. (Author's abstract)
W86-00908

2J. Erosion and Sedimentation

ACCUMULATION OF SEDIMENT ORGANIC MATTER IN A HARDWATER LAKE WITH REFERENCE TO LAKE ONTOGENY,
University of Southern Mississippi, Hattiesburg. Dept. of Biological Sciences.
G. L. Godshalk, and R. G. Wetzel.
Bulletin of Marine Science, Vol. 35, No. 3, p 576-586, November, 1984. 5 Fig, 4 Tab, 33 Ref. DOE grants EY-75-S-02-1599 and COO-1599-24 terways Experiment Station grant DACW M-1666.

Descriptors: *Organic matter, *Lake se *Lake ontogeny, Detritus, Hardness, Prim ductivity, Plant growth, Water depth, S erosion, Sedimentation, Particulate matte nology.

The occurrence and quality of detrital matter was investigated in sediments of hardwater lake. The objective of the study examine the interactions between plant pro ty and growth form, water depth, sedime and potential erosion and deposition proc the lake and their mutual impact on accu of detritus in the sediments. Of particular are the potential effects such accumulatio sediment dynamics and lake ontogeny. S core samples were taken on a transect f water's edge to the deepest part of the la ples of surficial, intermediate and deep s from all water depths were analyzed for co coarse particulate matter, organic matter, extractable humins and fulvic and humi Sediments at the surface in very shallow sediments of intermediate depth in the dee zone, and sediments at all depths in the waters contained the greatest concentra organic matter. Furthermore, those orga pounds were shown by spectrophotomet acterization to be old and probably very ry. The observed occurrence of sedimenta tal carbon is explained in terms of hypo synergistic effects of increasing product succession of littoral vegetation, differe composition rates controlled by propertie the substrate and the microenvironment influence of water movements and basin m gy on sediment erosion and deposition. (abstract)
W86-00643

CHEMICAL COMPOSITION OF RIVE MENTS FROM THE INDIAN SUB NENT,
Jawaharlal Nehru Univ., New Delhi School of Environmental Sciences.
V. Subramanian, L. Van 't Dack, and R. V Grieken.
Chemical Geology, Vol. 48, No. 1/4, p March, 1985. 3 Fig, 5 Tab, 16 Ref.

Descriptors: *River sediments, *Chemical sition, *Indian subcontinent, Sediments, ing, Watersheds, Geology, Catchment are

River sediments from all of the major basins (except the Indus) in the Indian s nent were collected and analysed by thi ray fluorescence technique (XRF) to d their chemical composition. On the basis sis of more than 120 samples, average compositions of river-borne sediments Indian sub-continent have been calculat average concentration values for sedime each of the river basins, and the sub- average and the inter-basin differences cussed in relation to weathering process drainage basins. Comparisons have been m the chemistry of sediments from the Bay (which receives the bulk of sediments deli Indian rivers). The observations are dis the light of average chemical compo world-river sediments and the world sur exposed for continental weathering. (Au stract)
W86-00771

ECONOMICS OF EROSION CONTRO SUBTROPICAL WASTERSHED: A I CAN CASE,
Ohio State Univ., Columbus. Dept. of Ag Economics and Rural Sociology.
A. Veloz, D. Southgate, F. Hitzhusen, an Macgregor.
Land Economics, Vol. 61, No. 2, p 145- 1985. 5 Tab, 24 Ref.

ptors: *Erosion control, *Dominican Repub-
Soil conservation, *Developing countries,
mic aspects, Land development, Regional
pment, Public policy, Land use, Reservoir

onomics of a soil conservation project for
tershed of the Valdesia hydroelectric dam,
ican Republic, were analyzed in terms of
-level and social level costs and benefits,
results interpreted in relation to the general
n of protecting soils in Third World coun-
and use and management were assumed to
ed by procedures judged by many special-
e appropriate to the Dominican Republic;
s classified into four classes based on slope,
fferent procedures specified for each slope
the land managment guidelines were fol-
it was estimated that the sedimentation rate
would drop 86%. It was calculated that a
duction in erosion would extend the life of
roelectric project by 6 yr, from 19 to 25 yr.
vate-level analyses have limited precision,
indicate that some farmers would have
no cost, and possibly some gain, from using
nagement measures. However, conversion
from traditional agriculture to a more soil-
ng use does not seem to be in the private
of many groups of farmers. Analysis of on-
acts using a social accounting stance sug-
t implementation of soil-conserving prac-
oughout the Valdesia reservoir catchment
tisfy the Hicks-Kaldor efficiency test. The
on that net social welfare would be im-
y reducing erosion is reinforced by incor-
the external benefits of soil conservation
evaluation. Lack of information, insecurity
tenure, and currency valuation problems
g the factors accounting for lack of wide-
doption of soil conservation by people in
rshed. Ultimately, making a constructive
including reduction of population growth)
ves of the inhabitants of areas like the
watershed is probably the only way to
nvironmental damage. (Rochester-IVI)
94

ROSION PROCESSES IN A COOL-
RATE ENVIRONMENT, ORWELL
INNESOTA,
kota Univ., Grand Forks. Dept. of Geol-

l, Jr.
al Society of America Bulletin, Vol. 96,
81-792, June, 1985. 17 Fig, 4 Tab, 49 Ref.

rs: *Bank erosion, *Orwell Lake, *Min-
eservoirs, Sheet erosion, Mass wasting,
radation, Thaw failure, Sublimation, In-
ce, Rain, Storms, Mudflows.

ke, in west-central Minnesota, is a flood-
water-management reservoir first im-
in 1953. Subsequent concern about ero-
e shoreline and a lack of knowledge of
ion processes in this part of the upper
prompted this study to identify and quan-
ocesses there. The processes were meas-
lected sites between June 1980 and June
sion of the banks is predominantly by
ire and secondarily by rainsplash and
. In winter, the upland surface adjacent
freezes to a depth of between 1 and 2 m,
on surface temperature, snow cover,
ce from exposed banks. In late winter,
gates, released by the sublimation of in-
e within the banks, begin to accumulate
e of the slopes, often veneering snow-
soon as thaw begins, slab failure of bank
s followed by mudflows and earthflows.
ire at Orwell Lake in the spring of 1982
for 89% of the erosion (824 Mg); the
spring, 78% (746 Mg). Such slope failure
tense along north-facing banks and con-
ess intense on south-facing banks, where
tive desiccation and sublimation reduce
re content. Summer rainsplash and
were responsible for 11%-22% of the
n, amounting to 102 Mg in 1981 and 208
2. Although rainsplash is the most con-
ocess during summer, the occasional
ng which rainwash occurs causes greater total erosion. Erosion by rain increased in each of the three summers, largely because of increased precipitation. Infrequent massive deep-slip failures (slumps) have occurred at the east end of the lake where a buried clay-rich unit is stratigraphically and topographically positioned to favor such failures. Drought years followed by heavy spring rains probably will result in additional deep-slip slope failures. (Author's abstract)
W86-00898

2K. Chemical Processes

MODEL OF SULPHATE CONCENTRATION IN A SMALL STREAM IN THE HARP LAKE CATCHMENT, ONTARIO,
Oslo Univ. (Norway). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W86-00629

FACTORS CONTROLLING MASS LOSS AND NITROGEN DYNAMICS OF PLANT LITTER DECAYING IN NORTHERN STREAMS,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
J. M. Melillo, R. J. Naiman, J. D. Aber, and A. E. Linkins.
Bulletin of Marine Science, Vol. 35, No. 3, p 341-356, November, 1984. 13 Fig, 4 Tab, 41 Ref. NSF grants DEB-80-05081, DEB-81-05677 and DEB-82-07055.

Descriptors: *Nitrogen, *Detritus, *Decomposition, *Streams, Water temperature, Nutrients, Dissolved oxygen, Lignin, Anaerobic conditions, Aerobic conditions, Microorganisms.

In this paper the influences of initial litter quality, exogenous nutrient supply, temperature and oxygen tension on decay rates and nutrient immobilization potentials of plant litter materials decomposing in northern streams are considered. A new method of estimating nitrogen and phosphorus immobilization potentials in decaying litter is reviewed, and the mechanisms responsible for nitrogen immobilization are discussed. Initial litter quality is the dominant factor that influences decay rate. Materials rich in nitrogen and poor in lignin generally decay most rapidly. Addition of nitrogen and/or phosphorus to the water often results(s) in increased decay rate as does elevation of water temperature. While low oxygen tension retards the decay of lignin and related compounds, it is not clear that low oxygen tension slows the rate of decay of more labile compounds. Initial litter quality is also the dominant factor that influences nitrogen immobilization potential. Materials poor in both nitrogen and lignin generally have the highest immobilization potentials. Addition of nitrogen to the water increases the immobilization potential of a litter material. Plant litter decomposing under anaerobic conditions immobilizes less nitrogen than the same litter decomposing under aerobic conditions. And, all other conditions being equal, temperature changes will influence nitrogen immobilization rate but not its maximum amount. The amount of nitrogen directly associated with microbial biomass makes up only a small fraction of the total nitrogen mass in decomposing litter. Microbes appear to be important agents in the nitrogen immobilization process on decaying litter. The microbes produce exoenzymes which in turn cause the degradation of large molecules such as polyphenolics and lignins. Some of these degradation products, such as the 'reactive phenolics,' recondense with nitrogen containing compounds. The degradation-recondensation cycle continues throughout litter decay, with the ultimate product being nitrogen-rich humic substances. (Author's abstract)
W86-00637

ALTERATION OF MICROBIAL METABOLIC ACTIVITIES IN ASSOCIATION WITH DETRITUS,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
H. W. Paerl.
Bulletin of Marine Science, Vol. 35, No. 3, p 393-408, November, 1984. 8 Fig, 1 Tab, 56 Ref.

Descriptors: *Detritus, *Microorganisms, *Metabolism, Microbial degradation, Microhabitats, Redox gradient, Protozoa, Invertebrates, Nutrients, Microzones.

Detritus serves as a microhabitat, or microzone, hosting redox gradients, altered microbial metabolism and associated biochemical nutrient transformation processes qualitatively and quantitatively distinct from the ambient planktonic environment. Through the application of tetrazolium redox indicator salts, microautoradiography and microelectrode analyses, it has shown that distributions of microbial communities and their extracellular deposition products on detrital as well as non-detrital submersed surfaces are patchy in nature, both in terms of physical distribution and associated metabolism. This patchiness promotes the development of steep redox gradients, which in turn lead to diverse microhabitats in which microorganisms, protozoans and invertebrates, all having narrow environmental tolerances, can reside. The compact nature of gradients helps promote diffusive exchange of metabolites, gases and nutrients, thereby maintaining community diversity and structural stability of microzones. Microzones also harbor specific nutrient transformation processes (i.e., nitrogen cycle N2 fixation, ammonification, nitrification and denitrification) which may otherwise be unfavorable or inhibited in ambient waters. The promotion, regulation and maintenance of specific nutrient transformation reactions in microzones are all implicated in determining nutrient availability and trophic states of affected aquatic systems. (Author's abstract)
W86-00639

CHEMICAL CHARACTERIZATION OF ESTUARINE COLLOIDAL ORGANIC MATTER: IMPLICATIONS FOR ADSORPTIVE PROCESSES,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 2L.
W86-00640

SPATIAL AND TEMPORAL COUPLING OF NUTRIENT INPUTS TO ESTUARINE PRIMARY PRODUCTION: THE ROLE OF PARTICULATE TRANSPORT AND DECOMPOSITION,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
For primary bibliographic entry see Field 2L.
W86-00642

ANALYSIS OF PRECIPITATION CHEMISTRY DATA FROM ALASKA,
National Oceanic and Atmospheric Administration, Rockville, MD. Air Resources Lab.
U. Dayan, J. M. Miller, W. C. Keene, and J. N. Galloway.
Atmospheric Environment, Vol. 19, No. 4, p 651-657, 1985. 5 Fig, 3 Tab, 28 Ref.

Descriptors: *Chemistry of precipitation, *Acid rain, *Alaska, Poker Flat, Point Barrow, Path of pollutants, Acidity, Polar regions, Sulfuric acid, Air trajectories.

The chemical composition of precipitation collected at Poker Flat, Alaska and at Point Barrow, Alaska was evaluated in conjunction with backward air trajectories to characterize the long-range transport of acidic materials to central Alaska. Volume weighted mean concentrations of major chemical constituents characterized the composition and acidity of precipitation associated with air parcels which arrive at Poker Flat from three major source regions, the Pacific Ocean, local continental and the Arctic. Long-range trajectories from the south-west predominated during the spring and early summer. These air flow patterns originated in mid-latitudes and generated precipitation with moderate acidities ($H(+) = 9.9$ micro-eq/l). Weak flows, suggesting local airmasses, were important sources of precipitation during mid

summer. Local storms corresponded to higher acidities (H(+) = 12.7 micro-eq/l). During the late summer and early autumn, precipitation events were frequently associated with northerly flows and lower acidities (H(+) = 7.8 micro-eq/l). H2SO4 was the most important source of acidity contributing, on a volume weighted basis, between 46 and 80% of free H(+) in all samples. The higher concentration of SO4(2-) relative to H(+) in Arctic storms suggests long distance transport and neutralization of anthropogenic H2SO4 from the Polar region. Concentrations of excess SO4(2-) measured in precipitation from Alaska were greater than those measured in precipitation from Greenland and less than those measured in precipitation from the Yukon of Canada. (Author's abstract)
W86-00659

EFFECT OF GROUNDWATER ON SOIL FORMATION IN A MORAINAL LANDSCAPE IN SASKATCHEWAN,
Saskatchewan Univ., Saskatoon. Saskatchewan Inst. of Pedology.
For primary bibliographic entry see Field 2F.
W86-00670

DENSITY OF PRECIPITATION CHEMISTRY NETWORKS,
Kozponti Cegkorfizikai Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 7A.
W86-00684

EFFECTS OF STORAGE ON THE COMPOSITION OF MAIN COMPONENTS IN RAINWATER SAMPLES,
Royal Netherlands Meteorological Inst., De Bilt.
T. B. Ridder, T. A. Buishand, H. F. R. Reijnders, M. J.'t Hart, and J. Slanina.
Atmospheric Environment, Vol. 19, No. 5, p 759-762, 1985. 3 Tab, 9 Ref.

Descriptors: *Chemistry of precipitation, *Rain, *Sample preservation, Chemical composition, Temperature, Light.

Samples from twelve rainwater collectors in The Netherlands were stored under three different conditions: (i) in the light at room temperature, (ii) in the dark at room temperature and (iii) in the dark at 4 C. In samples stored at room temperature, considerable changes occurred in ammonium and phosphate concentrations both in the light and in the dark. Minor changes were also observed for potassium, calcium, chloride, sulfate and nitrate. Storage of rainwater samples in the dark at 4 C resulted in a satisfactory sample preservation. (Author's abstract)
W86-00717

EULERIAN MODEL FOR SCAVENGING OF POLLUTANTS BY RAINDROPS,
General Motors Research Labs., Warren, MI. Environmental Science Dept.
For primary bibliographic entry see Field 5B.
W86-00718

COMPARISON OF SEVERAL METHODS FOR THE DETERMINATION OF IRON HYDROXIDES AND ASSOCIATED ORTHOPHOSPHATES IN ESTUARINE PARTICULATE MATTER,
McGill Univ., Montreal (Quebec). Inst. of Oceanography.
For primary bibliographic entry see Field 2L.
W86-00769

TRACE-METAL CONCENTRATIONS IN SEDIMENTS FROM TWO CLOSED-BASIN LAKES, ANTARCTICA,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2H.
W86-00770

INFLUENCE OF PH ON THE BINDING CAPACITY AND CONDITIONAL STABILITY CONSTANTS OF ALUMINUM AND NATURALLY-OCCURRING ORGANIC MATTER,
Savannah River Ecology Lab., Aiken, SC.
D. B. Pott, J. J. Alberts, and A. W. Elzerman.
Chemical Geology, Vol. 48, No. 1/4, p 293-304, March, 1985. 4 Fig, 3 Tab, 33 Ref. DOE contract EY-76-C-09-0819, NSF grant ISP-8011451.

Descriptors: *Hydrogen ion concentration, *Organic matter, *Aluminum, Humic acid, *Binding capacity, *Stability constants, Chemical reactions, Natural waters, Acidity.

The binding of Al by reagent grade humic acid and by a natural water system of the southeastern U.S.A. was investigated with special emphasis on the influence of pH. Differentiation of 'bound' Al and 'free' Al was performed using cation-exchange resins. A thermodynamic equilibrium model, GEOCHEM, was used to correct the 'bound' Al data for uncharged hydrolysis products. Two methods of data analysis, i.e. Scatchard and Langmuir regressions, were used to estimate conditional stability constants of Al-humic acid complexes. Overall stability constants (log10 K) for aluminum humate were about 6.8 with little variation over the pH range 3-5. Al binding capacities were higher in natural waters (0.99-2.86 micro-mol Al per mg DOC) relative to reagent grade humic acids (0.33-0.86 micro-mol Al per mg DOC). Both the natural waters and humic acid samples showed significant increases in Al binding capacity when pH was increased from 3 to 4 (0.99-1.84 micro-mol Al per mg DOC and 0.33-0.79 micro-mol Al per mg DOC, respectively). The humic acid showed a much smaller increase in binding capacity when the pH was increased from 4 to 5 (0.79-0.86 micro-mol Al per mg DOC). Arguments are presented to show that Al is bound to humic acid through a single type of binding site, most probably a carboxylic functionality. (Author's abstract)
W86-00773

NITROGEN TRANSFORMATIONS AND LOSS IN FLOODED SOILS AND SEDIMENTS,
Agricultural Research and Education Center, Sanford, FL.
K. R. Reddy, and W. H. Patrick.
CRC Critical Reviews in Environmental Control, Vol. 13, No. 4, p 273-309, 1984. 8 Fig, 5 Tab, 231 Ref.

Descriptors: *Nitrogen, *Flooded soils, *Sediments, Ammonification, Nitrification, Denitrification, Volatilization, Ammonia, Diffusion, Reservoirs, Wetlands.

Nitrogen transformations that account for transport of N from flooded soils and sediments to the atmosphere are reviewed. Characteristics of flooded soils and sediments, forms, sources, and trasformations of N in the environment, and the influence of plants on N loss are reviewed, and research needs in the nitrogen loss area are identified. N loss mechanisms in flooded soils are governed by N transformations (ammonification, nitrification-denitrification, and ammonia volatilization) and transport process (NH4-N diffusion and NO3-N diffusion), and the presence of plants. Nitrification-denitrification seems to be predominant in the loss of ammonium N from sediments, whereas ammonia volatilization occurs under specialized conditions, mainly in overlying waters. The processes involved in converting organic N to gaseous end products include ammonification of organic N to ammonium N, upward diffusion of ammonium N into the aerobic surface layer, oxidation of ammonium N in the aerobic soil layer, downward diffusion of nitrate N into the anaerobic soil layer, and reduction on NO3-N to gaseous end products such as N2 and N20. Data on the rates of N transformation by the various processes indicate that N diffusion and denitrification are not limiting in controlling N loss during the nitrification-denitrification sequence. Ammonium diffusion depends on the ammonium N removal mechanisms (nitrification and ammonia volatilization) in the aerobic soil layer and floodwater to establish a concentration gradient. In shallow reservoirs and wetlands flooded with wastewater, nitrification occurs at a rapid rate in the overlying water column, and the limiting process in the removal of nitrate from the overlying water was diffusion of NO3-N the water column to the underlying soil c The most important research need is for st volatilization losses by measuring the flu NH3 from an aquatic system in relation to ture, surface wind velocity, sediment char tics, alkalinity of the water, and biological in the soil-water system. (Rochester-IVI)
W86-00849

2L. Estuaries

EFFECTS OF TREATED SEWAGE EFFL AND BAY-BOTTOM MUD ON GROWT MARINE PHYTOPLANKTON,
For primary bibliographic entry see Field 5C
W86-00616

BIOLOGICAL CONSEQUENCES OF RAFTING IN A NEW ENGLAND SALT M COMMUNITY,
New Hampshire Univ., Durham. Jackson rine Lab.
M. N. Hardwick-Witman.
Journal of Experimental Marine Biology an ogy, Vol. 87, No. 3, p 283-298, May, 1985 47 Ref.

Descriptors: *Ice rafting, *Salt marshes, *I cal effects, New England, Mussels, Peat, Cordgrass, Growth, Mortality, Predation, tion, Marshes.

Ice rafting of salt marsh peat is a recurr nomenon in north temperate regions. This was simulated in a northern New Engl marsh to test several hypotheses concern effects of peat transport from high to low i heights on the growth and mortality of ke organisms: the ribbed mussel Geukensia (Dillwyn), the fucoid alga Fucus vesicu var. spiralis (Farlow) and the cordgrass alterniflora (Loisel.). Growth rates increas Geukensia and Fucus were transported lower intertidal; however, Spartina die similarly transported. Predation pressure (ly from Carcinus maenus L.) on Geuke greater when it was rafted to the lower i zone than in the upper intertidal habitat size specific; mussels > 3.5 cm reached escape from crab predation. A winter st dislodged mussels revealed that 72% of the collected were dead and 86% had been ov by large Fucus plants, > 2.5 x the natural cy of Fucus overgrowth (32%). In marsh where hard substratum is rare, 91% of th were growing on Geukensia. A dislodge periment showed that a significantly gre centage of Geukensia was dislodged afte when Fucus was attached to the shell th mussels without Fucus overgrowth. In th a population survey conducted in the sa examined densities, biomass and populati ture of Geukensia, as well as densities, cover and biomass of Fucus. Values ob the foremarsh were compared to those peat islands recently rafted to the tidal fl biomass and densities of Geukensia were the two areas; however, the size-frequen butions of the mussels were different. Sin large mussels, Fucus and Fucus-overgro sels were found on the newly transpor islands, this pattern appears to reflect dislo of larger Geukensia by attached algae d transport. Two ice-related sources of were identified for Geukensia: (1) Fuc growth acted as vector for mussel dislo and was an indirect source of mortality; a crushing was a direct source of mortality overgrown mussels. (Author's abstract)
W86-00627

RESPONSE OF A DETRITAL FOOD EUTROPHICATION,
Marine Biological Lab., Woods Hole, MA
For primary bibliographic entry see Field
W86-00638

ICAL CHARACTERIZATION OF ESTU-
COLLOIDAL ORGANIC MATTER: IM-
TIONS FOR ADSORPTIVE PROCESS-

nd Univ., Solomons. Chesapeake Biological

eans, and R. D. Wijayaratne.
of Marine Science, Vol. 35, No. 3, p 449-
vember, 1984. 3 Fig, 3 Tab, 49 Ref.

tors: *Colloids, *Organic matter, *Adsorp-
Estuarine environment, Particulate matter,
ed solids, Geochemistry, Lipids, Carbohy-
Amino acids, Seasonal variation.

ed and particulate organic matter are im-
components of the carbon and nitrogen
Because of their surface active nature and
y, dissolved organic colloids are also im-
in many geochemical processes. The chem-
re of colloidal organic matter is an impor-
tor in determining how it will behave in
to other substances in the system. In the
study, colloidal organic matter (> 0.4
to 1.2 nm) collected from the Chesapeake
ary over a salinity range of 2 to 22% was
rized for organic carbon (DOC), lipid
carbohydrate (TDS) and amino acids
Analysis of the biochemical constituents of
organic carbon indicated that (TDS),
nd (TDL) account for 35-60%, 4-13% and
1%, respectively, of the DOC content.
S fraction had a predominance of glucose
actose while the TAA fractions showed
undances of aspartic, glutamic, serine,
and glycine. Seasonal changes in the TDS
A levels in estuarine colloids revealed that
nd amino acids were higher in summer
winter, and may be related to primary and
y productivity. Enrichment of carbohy-
d amino acids in colloidal material collect-
a density boundary (pycnocline) was ob-
The results of this study are discussed in
of these biogenic polymers acting as a
n the enrichment. (Author's abstract)
40

RADIENT CONCEPT OF DETRITUS
PORT AND PROCESSING IN ESTU-

Univ., Charlottesville. Dept. of Environ-
ciences.
lum.
of Marine Science, Vol. 35, No. 3, p 510-
ember, 1984. 7 Fig, 1 Tab, 40 Ref. NSF
9674.

ors: *Detritus, *Estuarine environment,
ansport, Particulate transport, Salinity,
Stream order, Organic carbon, Dissolved
articulate matter, Productivity, Aquatic

ept that organic detritus is not uniformly
d in estuaries, but occurs principally
o gradients, the salinity axis gradient and
n stream order gradient is proposed. Pre-
evidence suggests that DOC and POC are
d along these gradients in generally de-
concentrations from the sources, river
the first case and tidal marsh carbon in
d. Processing of detritus along the salinity
ent is due principally to physical process-
s flocculation while biological processes
re important role along the marsh stream
dient. The potential carbon sources for
consumers along the marsh stream order
should demonstrate a shift from predomi-
scular plant detritus, benthic microalgae,
bly, carbon from terrestrial sources in the
r streams to phytoplankton and phyto-
detritus in the larger streams and embay-
rge beds of submerged macrophytes such
ses can introduce considerable variation
rends in DOC and POC concentrations.
se phenomenon are important in consid-
f the relative importance of organic detri-
energy source for estuarine consumers.
abstract)
1

SPATIAL AND TEMPORAL COUPLING OF NUTRIENT INPUTS TO ESTUARINE PRIMARY PRODUCTION: THE ROLE OF PARTICULATE TRANSPORT AND DECOMPOSITION,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
W. M. Kemp, and W. R. Boynton.
Bulletin of Marine Science, Vol. 35, No. 3, p 522-535, November, 1984. 6 Fig, 1 Tab, 78 Ref.

Descriptors: *Estuarine environment, *Nutrients, *Primary productivity, *Particulate transport, *Decomposition, *Patuxent River, *Maryland, Solute transport, Nitrogen, Phosphorus, Dissolved solids, Particulate matter, Plankton, Salinity, Sedimentation, Resuspension, Water temperature.

Spatial and temporal aspects of the coupling of nutrient inputs to estuarine primary production are discussed in terms of formation, transport and decomposition of particulate material in the Patuxent River estuary. Mixing diagrams of dissolved and particulate nitrogen and phosphorus (DIN, PN, DIP, PP) versus salinity indicate rapid removal of DIN and DIP with parallel formation of PN and PP in the slightly brackish (0-5%) region. However, plankton production (per sq m) tends to be inversely related to salinity between 0 and 10%. While most of the annual nutrient inputs to the Patuxent occur between December and April, peak plankton production occurs in the summer. Deposition and resuspension of particulate substances in this system are dynamic processes which decrease in a seaward direction. Regeneration of DIN and DIP from particlate decomposition in the sediments similarly decreases toward the estuary's mouth; however, highest rates are in the 5-10% region. Temporal patterns of benthic regeneration and plankton production are congruent (being generally related to temperature), and rates of sediment NH4(+) recycling represent about 60-80% of the plankton assimilative demand in the 5-10% region. On the basis of these observations a conceptual model is proposed in which annual inputs of dissolved nutrients from runoff are converted into particulate forms which are gradually transported seaward through cycles of deposition and resuspension. As temperatures rise in the summer these particulates are decomposed, releasing dissolved nutrients to the euphotic zone where they support the major annual blooms of plankton. By comparing these patterns for the Patuxent with those reported for other estuaries, it is suggested that this model may be relatively general for many coastal systems. (Author's abstract)
W86-00642

GROWTH IN BIOMASS OF BALANUS BALANOIDES YOUNG AT VARIOUS CURRENT VELOCITIES,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
For primary bibliographic entry see Field 2H.
W86-00721

EFFECT OF VELOCITY OF WATER FLOW ON GROWTH OF COLONIAL HYDROIDS (HYDROZOA, THECAPHORA),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 2H.
W86-00722

COMPARISON OF SEVERAL METHODS FOR THE DETERMINATION OF IRON HYDROXIDES AND ASSOCIATED ORTHOPHOSPHATES IN ESTUARINE PARTICULATE MATTER,
McGill Univ., Montreal (Quebec). Inst. of Oceanography.
M. Lucotte, and B. d'Anglejan.
Chemical Geology, Vol. 48, No. 1/4, p 257-264, March, 1985. 2 Fig, 3 Tab, 24 Ref.

Descriptors: *Iron hydroxides, *Orthophosphates, *Particulate matter, *Estuarine environment, Minerals, Sediments, Suspended solids, Analytical methods, Phosphorus, St. Lawrence Seaway, Eastmain River Estuary, Quebec.

Five different methods commonly used for the extraction and the determination of iron hydroxides and/or the associated phosphorus held in marine seston or in sediments have been tested on single-phase minerals (goethite and apatite), on reference minerals (SO1 and SO2), and on suspended-matter samples from the St. Lawrence Estuary and from the estuary of the Eastmain River, a major James Bay affluent in northern Quebec, Canada. The citrate-dithionite-bicarbonate (CDB) procedure generally seemed to be more reproducible and more specific. The validity of the other methods respectively using as extracting reagents ammonium oxalate-oxalic acid, hydroxylamine hydrochloride, calcium nitrilotriacetic acid and acetate-tartrate is discussed. The CDB extraction is included in an analytical scheme which allows to distinguish between three fractions of phosphorus. This chemical speciation is applied to the study of P retention on Fe-hydroxides, and to its potential desorption. (Author's abstract)
W86-00769

HISTORICAL CHANGES IN SUBMERGED MACROPHYTE COMMUNITIES OF UPPER CHESAPEAKE BAY,
California Univ., Santa Barbara. Dept. of Geography.
For primary bibliographic entry see Field 2H.
W86-00828

SEASONAL CYCLES OF PHYTOPLANKTON POPULATIONS AND TOTAL CHLOROPHYLL OF THE LOWER ST. JOHNS RIVER ESTUARY, FLORIDA,
University of North Florida, Jacksonville. Dept. of Natural Sciences.
C. DeMort, and R. D. Bowman.
Biological Sciences, Vol. 48, No. 2, p 96-107, 1985. 5 Fig, 4 Tab, 18 Ref.

Descriptors: *Phytoplankton, *Chlorophyll, *Seasonal variation, *St. Johns River Estuary, *Florida, Population dynamics, Species diversity, Salinity, Phosphates, Hydrogen ion concentration, Estuarine environment.

Monthly plankton collections and water analyses were made at 7 stations along the lower 42 km of the St. Johns River Estuary (Florida) for a 2-yr period. Measurements included temperature, light extinction, salinity, dissolved oxygen, chlorophyll, nutrients, iron, copper, turbidity and pH. All of the stations exhibited major peaks in cell numbers and chlorophyll in June or July and secondary peaks in December or January. The total number of distinct population peaks decreased from 4, near the river's mouth, to 2 at the upper stations. Species diversity decreased with distance from the river's mouth, whereas, chlorophyll concentration increased. The chlorophyll concentration was correlated closely with cell counts at most stations. Population density appeared to be most closely correlated with salinity, phosphate, and pH. High N:P ratios occurred throughout the year, suggesting that phosphorus is more limiting than nitrogen in the St. Johns River system. (Author's abstract)
W86-00900

INFLUENCE OF SALINITY ON SCIRPUS AMERICANUS TIDAL MARSHES IN THE ST. LAWRENCE RIVER ESTUARY, QUEBEC,
Laval Univ., Quebec. Dept. of Civil Engineering.
J. Deschenes, and J.-B. Serodes.
Canadian Journal of Botany, Vol. 63, No. 5, p 920-927, May, 1985. 4 Fig, 1 Tab, 22 Ref.

Descriptors: *Salinity, *Tidal marshes, *Bulrushes, *St. Lawrence River estuary, *Quebec, Sodium, Aquatic plants, Marshes, Brackish waters, Estuaries.

The amount of sodium in the aboveground part of the stalks of Scirpus americanus taken at the peak of biomass is a good indicator of the amount of salinity in the waters flooding the tidal marshes of an estuary. In fresh water, the Na concentrations remain below 10,000 and then increase sharply up to 20,000 - 30,000 mg/kg in brackish waters. Even

though this plant can grow under brackish conditions, salinity has a considerable effect on the percentage of submersion it can withstand. Consequently, in the presence of saline water, the lower limit of the vegetation regresses towards the shore. In the case of fresh water, Scirpus americanus occupies the lower part of marshes up to an average of 75% of submersion, while in brackish water it extends to about 35% and then disappears when waters are more saline. (Author's abstract)
W86-00902

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

LENGTH AND SLOPE EFFECTS ON RUNOFF FROM SODIUM DISPERSED, COMPACTED EARTH MICROCATCHMENTS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
S. R. Evett, and G. R. Dutt.
Soil Science Society Journal of Americal, Vol. 49, No. 3, p 734-738, May-June, 1985. 3 Fig, 3 Tab, 22 Ref. USDA grant 82-CRSR-2-2005.

Descriptors: *Water harvesting, *Runoff, *Microcatchments, *Compacted earth, *Slope, *Downslope length, Salts, Rainfall intensity, Model studies, Salinity, Storms, Soil permeability.

A study was conducted on the effects of slope and downslope length on daily runoff and erosion from earthen microcatchments treated with sodium salt and compacted. Two replicates of a two-factor experiment, including 1, 5, 10, and 15% slopes and 3- and 6-m lengths, were built on a gravelly sandy clay loam (mixed mineralogy) using 11.2 t/ha of NaCl mixed into the surface 2 to 5 cm of soil followed by compaction with a 6-t roller after a heavy rain. Total runoff was measured volumetrically after each of 18 storms. Both slope and length had effects on runoff significant at the 0.1% probability level but the effect of rainfall intensity was not significant. The best fit linear model of runoff explained about 98% of the variability in runoff on individual plots for individual storms but explained no differences in runoff among treatments. A nonlinear model incorporating slope and length accounted for about 96% of the variability in average total runoff among treatments. This model shows that the important differences in runoff among treatments can be explained by slope and length alone for these conditions. Only a minor salinity problem but slight to moderate permeability problems might be expected. No apparent problems have arisen in 12 yr of grape and fruit tree cultivation in a water harvesting system using this type of catchment on the same soil. (Moore-IVI)
W86-00705

WATER FOR SALT LAKE CITY,
Salt Lake City Dept. of Public Utilities, UT.
W. E. Evensen.
Public Works, Vol. 116, No. 6, p 102-104, June, 1985. 2 Fig.

Descriptors: *Salt Lake City, *Utah, *Water supply development, *Water conveyance, Water mains, Tunnel construction, Reservoir construction, Financing.

Salt Lake City, Utah, is the major trading center of the Intermountain region of the western United States. In recent years it has experienced a population decline concomitant with an increase in demand for water from the city supply system. This demand resulted from expansion of non-residential developments, including office buildings and hotels. Today's demand of about 96,000 acre-ft is met through four treatment plants located on canyon streams leading from the Wasatch Mountains. Beginning in 1984, additional water became available from the Jordan Aqueduct portion of the Central Utah Project. To take advantage of this supply a large connecting supply line was needed to bring the water to the city's west side. Since 1976, a capital improvement program has been underway to provide the connection to the aqueduct and a 12 million gallon terminal, the Victory Road Reservoir. Numerous engineering challenges were presented by different phases of this project, including dealing with seepage from beneath the reservoir site, tunneling beneath a major railway line, and evaluation of the hazard connected with major water mains crossing a fault line. The city's former cash-only financing methods had to be changed to obtain $25 million for funding the project. In addition to the reservoir, which is 280 ft in diameter, 30 ft deep, and completely buried, major 48 inch and 36-inch supply lines, major 30- and 24-inch branches, and tie-ins to existing distribution systems were constructed. (Rochester-IVI)
W86-00809

BULK SUPPLY SCHEME OF THE MID SOUTHERN AND NORTH SURREY WATER COMPANIES,
North Surrey Water Co., Staines (England).
P. O. Packham, and E. G. Moss.
Journal Institution of Water Engineers and Scientists, Vol. 39, No. 2, p 155-168, April, 1985. 5 Fig, 1 Append.

Descriptors: *Water supply development, *England, *Thames River, Organizations, Pipelines, Water transport, Costs, Economic aspects, Administrative agencies.

The Mid Southern Water Company (England), which serves an area undergoing rapid population increase due to 'overspill' from the city of London, successfully increased its capacity by cooperating with the North Surrey water company in a bulk supply scheme. Water is obtained from the upper Thames at the North Surrey's Egham plant, and pumped to a new reservoir constructed at Surrey Hill, from which water is distributed into the existing Mid Southern network. To carry water from Egham to Surrey Hill, a 900 mm trunk main 20.5 km long was constructed. Project costs were (million pounds sterling): Egham works, new pumphouse and uprating of treatment plant, 1.3; trunk main, 4.6; and Surrey Hill Reservoir (excluding outlet main), 1.3. A bulk supply of up to 22 million liters/day can be obtained from the new system, which has been averaging 18 million liters/day since opening in June of 1982. Additional development of Egham Works in the future will bring the bulk supply up to 75 million liter/day. This project was administratively complex because it involved two separate water companies, plus water under the control of the Thames Water Authority. The history of administrative and legal arrangements and discussions of cost sharing are detailed in this paper. (Rochester-IVI)
W86-00835

3F. Conservation In Agriculture

CHEMICAL AND STUBBLE-MULCH FALLOW INFLUENCES ON SEASONAL SOIL WATER CONTENTS,
Agricultural Research Service, Sidney, MT. Northern Plains Soil and Water Research Center.
D. L. Tanaka.
Soil Science Society of America Journal, Vol. 49, No. 3, p 728-733, May-June, 1985. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Conservation tillage, *Soil water content, *Fallow, Seasonal variation, Chemical fallow, Stubble mulch fallow, Water conservation, Precipitation frequency.

A study was conducted in the northern Great Plains to determine the effect of chemical and stubble-mulch fallow of a Williams loam (fine-loamy mixed, Typic Argiborolls) on soil water contents during 14- and 21-month fallow periods. Soil water contents to a depth of 1.70 m measured by use of the neutron-scatter technique for two 14- and three 21-month fallow periods. The amount of surface residue after harvest range from 0.6 to 3.6 Mg/ha during the study. Chemical fallow maintained more surface residue than stubble-mulch fallow, but no significant differences in soil water contents to 1.70-m soil depth occurred betw treatments. Gain in soil water occurred af vest and over the first winter with soil wa generally occurring during summer for 14- months of fallow. No gain in soil water c occurred over the second winter when che fallowed for 21-months. Precipitation fre and distribution may be just as important as ty and position of surface residue for ch fallow to effectively store more soil wat stubble-mulch fallow. (Author's abstract)
W86-00704

SEEPAGE-LIMITATION OPTIMIZATIO THE SHAPE OF AN IRRIGATION CHA BY THE INVERSE BOUNDARY-V PROBLEM METHOD,
N. B. Il'inskii, and A. R. Kasimov.
Fluid Dynamics, Vol. 19, No. 3, p 404-41 June, 1984. 6 Fig, 13 Ref.

Descriptors: *Irrigation practice, *Chann phology, *Seepage, *Inverse boundar method, Soil water, Backwater, Capillarity oration, Infiltration, Drainage.

Equations are presented for finding the cross-sectional shape for an irrigation cha minimize seepage loss. Seepage was assume one-dimensional, steady, and to satisfy law. Capillarity, infiltration, and evaporatio ignored in the calculations, which acco seepage without backwater, seepage with t ter (ie, when the velocity at infinity va seepage into a horizontal drainage layer, a age into a water-bearing layer. For chann unit cross-sectional area, the seepage witho water from the optimal channel is 5.67% than for a rectangular channel, and the re compared to a trapezoidal channel is 6.2% case of an optimal channel through a pe layer, the head in the underlying horizontal able layer has a profound effect on seepa rate of the optimal channel. (Rochester-IVI
W86-00869

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

MONITORING URBAN WATERWA REDUCE FLOOD DAMAGE AND E PUBLIC SAFETY,
Canadian Applied Technology, Toronto (O
E. House.
Water and Pollution Control, Vol. 123, N 22-23 and 59, May/June, 1985.

Descriptors: *Flood control, *Forecastin ronto, *Ontario, Monitoring, Rivers, Flow, etry, Measuring equipment, Remote sensing

The primary objective of the Metropolitan to and Region Conservation Au (MTRCA's) flood forecasting center is to the public, business and local municipalit sufficient advanced warning of possible events, along with the magnitude and the of the hazard. In order to provide the mo rate and timely forecasts, the urban hyd must act quickly to collect the most histor current information for each river syste information is used in conjunction with hy knowledge of each river system, such as changing information on watershed land physiography, stream flow and the state control facilities. The MTRCA monitors systems' water level or flow, snow pack tion, soil conditions and weather informati as the duration and amount of precipitati perature, relative humidity, wind speed an tion. The MTRCA has identified 33 maj prone sites and 200 minor flood prone sit river systems. Located at stragetic sites,

am from a flood prone site, are small shelters gauging houses which measure the river's level in order to determine flow. The use of g as well as telemetering equipment enables nt contact to be maintained with the measur-ions. (Baker-IV)
0687

GES IN SOIL CARBON AND NITRO-DUE TO IRRIGATION DEVELOPMENT BRASKA'S SANDHILL SOILS,
ka Univ.-Lincoln. Dept. of Agronomy.
imary bibliographic entry see Field 6G.
0703

LOPING AN EFFECTIVE STORM AGE MAINTENANCE PROGRAM,
llins, CO.
emoen, M. Mercer, and R. E. Krempel.
Works, Vol. 116, No. 6, p 84-88, June, 1985.

tors: *Maintenance, *Drainage systems, drains, *Fort Collins, *Colorado, Manage-anning, Land use planning, Channels.

ance of storm drainage ways has lagged other public works management practices. experiences in Fort Collins, Colorado, trate both how neglected channels can a problem and how an organized mainte-ffort can achieve a solution. Maintenance drainage facilities first involves planning, h problems, needs, and opportunities are d and goals and objectives are specified. the plan must be implemented through ment of policies, programs, and priorities. upkeep is not the only function required. ational and financial arrangements must be to achieve the objectives. Three examples beyond physical upkeep and incorporate nce aspects into the overall stormwater s are (1) design criteria, which formalize ve maintenance through good design, (2) ster planning, and (3) open space/land use ations. The final stage in maintenance is ntation, evaluation, and verification of ef-ss of the program, in which three key e (1) communicating with the public, (2) ing quality of maintenance efforts, and (3) eative in both physical and management f drainage maintenance. (Rochester-IVI)
06

RTIONAL WEIRS FOR STORMWATER UTLETS,
uthwell, Inc., Englewood, CO.
ary bibliographic entry see Field 8A.
87

roundwater Management

LOGIC AND VEGETATIONAL ES RESULTING FROM UNDER-D PUMPING AT THE CYPRESS WELL FIELD, PASCO COUNTY, A,
t Florida Water Management District, le.
ary bibliographic entry see Field 6G.
09

fects On Water Of 's Non-Water vities

NG THE CUMULATIVE EFFECTS OF PRACTICES ON DOWNSTREAM C ECOSYSTEMS,
Associates, Wenatchee, WA.
ary bibliographic entry see Field 6G.
1

CTION OF WATER RESOURCES - ST CRITICAL ECOLOGICAL CRISIS ASIA,
International Union for Conservation of Nature and Natural Resources, New Delhi (India).
N. D. Jayal.
Ambio, Vol. 14, No. 2, p 95-98, 1985. 3 Fig, 4 Ref.

Descriptors: *Water resources development, *East Asia, *Water pollution effects, *Hydrological cycle, Environmental effects, Planning, Water management, Drought, Water conservation.

The destruction of the life-support systems of the poor and marginal populations in the East Asian region is the real cause of growing poverty and deprivation that in turn is related to a whole spectrum of economic and social problems. The destruction of water resources is increasingly becoming the most severe threat to survival in the countries of the south. This destruction is arising in two ways: by the disruption of the hydrological cycle on which the renewability and sustained availability of water depends, and by the pollution of water systems with industrial and urban wastes. Conventional meanings of water conservation reflect the engineering approach to handling of the natural-resource crises. Water conservation in this approach is reduced to impounding river water in large dams, to building large networks of concrete-lined canals. This water conservation strategy does not solve the water crisis of the marginal populations. A water conservation strategy that aims at being sustainable needs to be based on ecological principles. It has to recognize that water resources get destroyed either by excessive withdrawals of natural resources from an ecosystem or by excessive additions of wastes into an ecosystem. Conservation of water in Asian societies means avoiding the destructive and distorted use of resources. It means respecting essential ecological processes like the hydrological cycle and the difference between vital and non-vital needs. (Baker-IVI)
W86-00666

GOLD-MINING EFFECTS ON STREAM HYDROLOGY AND WATER QUALITY, CIRCLE QUADRANGLE, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. M. Bjerklie, and J. D. LaPerriere.
Water Resources Bulletin, Vol. 21, No. 2, p 235-243, April, 1985. 3 Fig, 4 Tab, 8 Ref. EPA project 808340-01.

Descriptors: *Gold mining, *Hydrology, *Water pollution effects, *Circle Quadrangle, *Alaska, Placer mining, Streams, Subsurface water, Chemical properties, Water level, Stream flow, Specific conductance, Dissolved oxygen, Mine drainage, Sediments.

Effects of placer mining on the hydrology and water quality of several interior Alaska streams were studied as part of a project on the impacts of placer mining on stream ecosystems. Surface and subsurface waters were analyzed in the field for conductivity, pH, temperature, alkalinity, total and calcium hardness, iron, copper, manganese, ammonia-N, nitrate-N, nitrite-N, settleable solids, and turbidity. Total, nonfiltrable, and filtrable residues were determined in the laboratory. In the streams placer mining increased turbidity, settleable solids, nonfiltrable and filtrable residues and total iron. Surface and subsurface water levels, as measured in wells driven in the stream beds, were correlated with stream flow. Fine sediment deposited on stream beds in mined drainages reduced the hydraulic contact between the surface and subsurface waters of the stream and caused the piezometric water level to be below the surface water level of the mined streams. This resulted in higher specific conductance and significantly lower dissolved oxygen concentrations in the subsurface waters of mined streams compared to their surface waters. No significant differences were found for any water quality characteristics comparing surface to subsurface waters for the unmined streams. (Author's abstract)
W86-00785

4D. Watershed Protection

USING SIMULATION TO ASSESS THE IMPACTS OF CONSERVATION TILLAGE ON MOVEMENT OF SEDIMENT AND PHOSPHORUS INTO LAKE ERIE,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
D. B. Beasley, E. J. Monke, E. R. Miller, and L. F. Huggins.
Journal of Soil and Water Conservation, Vol. 40, No. 2, p 233-237, March/April, 1985. 1 Fig, 6 Tab, 11 Ref.

Descriptors: *Erosion control, *Lake Erie, *Conservation tillage, *Sediment transport, *Phosphorus, Simulation, Nutrients, Sediment yield, Agricultural watersheds, Tillage.

Attempts were made to develop and test a methodology based on the ANSWERS model for making basin wide predictions of sediment and nutrient yields using a small, stratified sample; to provide a means of quantifying the impacts that various conservation tillage applications could have on overall sediment and P yields to Lake Erie; and to study the effects of different sample sizes on the predicted basin responses. Eighteen sample watersheds, a 1.0% sample of the total Lake Erie basin, represented the major soil groups in the area of study. Land in the study area was typically flat to rolling, requiring both subsurface and surface drainage. The cropland, between 65 and 80% of the area, is productive. Typical tillage management included fall moldboard plowing and spring disking. But use of the chisel plow and several conservation tillage practices is increasing. Soil erosion rates and associated P yields in the western basin are rather small compared with those in many highly productive agricultural areas. The basic problems are that the soils typically have a high clay content and thus a large capacity for P transport. The receiving body, Lake Erie, is already eutrophic. The simulation concluded that the reduction achievable in phosphorus and sediment transport from conservation tillage only probably would not meet the international agreement goals. The roughly 1,100 t/yr reduction required of the study area could only be met with a greater than 50% change over to no-till. A realistic, short-term expectation might be a 50% switch to chisel plowing resulting in a reduction of 831 t/yr if the entire basin is treated or of 587 t/yr if only group 2 soils were treated. (Baker-IVI)
W86-00650

WATERSHED PLANNING FOR ACID MINE DRAINAGE ABATEMENT,
Georgia Univ., Athens. School of Environmental Design.
B. K. Ferguson.
Water Resources Bulletin, Vol. 21, No. 2, p 253-263, April, 1985. 13 Fig, 1 Tab, 10 Ref.

Descriptors: *Acid mine drainage, *Watershed management, *Water pollution control, *Blacklick Creek Watershed, *Pennsylvania, Planning, Priorities, Abandoned mines, Water quality, Land use, Mapping.

Acid drainage from abandoned mines is a widespread problem in old mining regions. Agencies seeking to abate it face the prospect of dealing with hundreds of potential abatement projects, stretching decades into the future. A systematic regional analysis is necessary to establish locations, objectives, priorities, and phasing of such projects. The U.S. Bureau of Mines developed a novel procedure for abatement planning in the 420 square mile Blacklick Creek Watershed in Pennsylvania. The plan sought to direct abatement projects toward pollution sources where degradation was worst and adverse effects greatest. It established abatement priorities by comparing the 'supply' of sources to be reclaimed (the degrees of old mines' water quality degradation) with the 'demand' for abatement to be done (the natural and cultural values represented by the region's demography, land use and other non-mining characteristics). Matrices were used to define the relationships among mining and non-mining factors; maps were developed to show the geographic distribution of the conclusions. The locations, priorities, and phasing of abatement objectives shown on the maps should provide guidance for any abatement effort,

no matter what type of technology is applied to achieve the objectives. Over the many years in which abatement projects are to be performed in the Watershed, the plan can be used to define, coordinate, and establish priorities for the projects in a manner that can result in maximum abatement benefits from the application of limited funds. (Author's abstract)
W86-00787

ECONOMICS OF EROSION CONTROL IN A SUBTROPICAL WASTERSHED: A DOMINICAN CASE,
Ohio State Univ., Columbus. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 2J.
W86-00894

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EFFECT OF SULFITE DECHLORINATION ON THE ACCUMULATION OF WATERBORNE LEAD BY RAINBOW TROUT (SALMO GAIRDNERI),
Canada Centre for Inland Waters, Burlington (Ontario).
P. V. Hodson, and D. J. Spry.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 841-844, April, 1985. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Bioassay, *Lead, *Sulfites, *Dechlorination, *Trout, Bioaccumulation, Heavy metals, Organic matter, Water treatment, Charcoal filtration.

Chlorine can be removed from laboratory water supplies by reduction with sodium sulfite, but sulfite complexation of metals may bias aquatic toxicity tests. The effect of waterborne sulfite on the accumulation of waterborne lead by rainbow trout (Salmo gairdneri) was tested. After 96 h, the blood lead levels of trout exposed to both 100 micro-g lead/L and 440 micro-g sodium sulfite/L were lower than those exposed to lead alone. The highest level of sodium sulfite having no effect on blood lead was 20 micro-g/L. The addition of 200-300 micro-g sodium sulfite/L to the water supply after charcoal filtration removed residual chlorine levels rapidly and completely. This reaction, and other possible reactions with organic matter, always reduced measureable sulfite levels to less than 1 micro-g/L (limit of detection), a level much lower than those tested. Hence, sulfite dechlorination should not interfere with metal bioassays. (Author's abstract)
W86-00615

OLIGOCHAETE COMMUNITIES OF THE SUBLITTORAL AS INDICATORS OF LAKE GENEVA EUTROPHICATION,
Conservation de la Faune, Saint-Sulpice (Switzerland).
C. Lang.
Archiv fur Hydrobiologie, Vol. 103, No. 3, p 325-340, May, 1985. 3 Fig, 4 Tab, 28 Ref.

Descriptors: *Oligotrophic lakes, *Eutrophication, *Lake Geneva, *Switzerland, *Oligochaetes, Population dynamics, Water pollution effects, Sublittoral zone, Pollution indicators, Bioindicators, Monitoring.

The oligochaete communities, mostly tubificid and lumbriculid worms, were sampled in 1982 in the sublittoral area (40 m deep) on the northern coast of Lake Geneva (Switzerland) and results were compared to those from a 1977 study. Primary production of phytoplankton in the lake and organic inputs by the Rhone River (70% of total input) were lower before the 1977 survey than before the 1982 survey. The absolute density of all the oligochaetes, of mesotrophic and of eutrophic worm species was higher in 1982 than in 1977, even if differences due to the more efficient sampling were eliminated. In both surveys, the absolute density of oligotrophic species was the same. These species were less abundant than mesotrophic or eutrophic species. The relative density of mesotrophic worm species was higher in 1982 than in 1977, perhaps due to the effect of the season. The percentage of oligochaete communities typical of mesotrophic conditions, i.e. wherein relative density of mesotrophic species was equal or superior to 50%, was higher in 1982 than in 1977. In 1982, the mean biomass of the macrobenthos per area decreased according to the increase in distance from the inflow of the Rhone River. The proportion of the oligochaete communities typical of oligotrophic, of mesotrophic and of eutrophic conditions encountered during the 1977 and the 1982 surveys was used to indicate the probability for Lake Geneva to be in a given trophic state. (Baker-IVI)
W86-00624

FLUORIMETRIC DETERMINATION OF TRACE HYDROGEN PEROXIDE IN WATER WITH A FLOW INJECTION SYSTEM,
Texas Tech Univ., Lubbock. Dept. of Chemistry.
H. Hwang, and P. K. Dasgupta.
Analytica Chimica Acta, Vol. 170, No. 2, p 347-352. 3 Fig, 17 Ref. U.S. EPA grant R810894-010.

Descriptors: *Fluorometry, *Hydrogen peroxide, *Flow injection, Hydroxyphenylacetic acid, Peroxidase, Ammonia, Water analysis, Chemical analysis, Chemistry of precipitation.

Although many selective spectrophotometric and electrochemical methods for determination of hydrogen peroxide have been described, the requisite sensitivity for applications to precipitation and cloudwater limits the approaches to the more sensitive luminescence methods. A fluorimetric flow-injection procedure with a single reagent solution containing p-hydroxyphenylacetic acid, peroxidase and ammonia permits the determination of aqueous hydrogen peroxide in the range 10 to the -8 power to 10 to the -4 power M; 30-60 samples can be processed per hour. The method exhibits a wide linear range and is insensitive to sample pH within the range 2-6. After 48 h the determination of very low concentrations was impaired. (Collier-IVI)
W86-00645

METHOD FOR AQUATIC MULTIPLE SPECIES TOXICANT TESTING: ACUTE TOXICITY OF 10 CHEMICALS TO 5 VERTEBRATES AND 2 INVERTEBRATES,
Environmental Research Lab.-Duluth, MN.
G. L. Phipps, and G. W. Holcombe.
Environmental Pollution (Series A), Vol. 38, No. 2, p 141-157, 1985. 4 Tab, 19 Ref.

Descriptors: *Toxicity, *Testing procedures, *Fish, *Invertebrates, Organic compounds, Water pollution effects, Crayfish, Snails, Chlorinated hydrocarbons.

A more efficient method was sought for conducting aquatic acute toxicity tests so the resulting data would be directly comparable between species. This method produced LC50 data on several species at a fraction of the time and money it takes to produce them by using individual tests for each species. Species tested included fathead minnows, goldfish, channel catfish, bluegill, rainbow trout, crayfish, snails, and chinook salmon. Compounds tested included pentachlorophenol, 2-chloroethanyl, 2,4-pentanedione, hexachloroethane, alpha-bromo-2',5'-dimethoxyacetophenone, benzaldehyde, 1,3-dichloro-4,6-dinitrobenzene, dursban, sevin, and cadmium chloride. The method as developed permits acute toxicity tests to be conducted on several species in different chambers of the same exposure tank. It allows an easy determination of the most sensitive species and cuts cost of labor, materials and chemical analyses for measured concentration tests. (Baker-IVI)
W86-00654

ALLIUM TEST ON RIVER WATER FROM BRAAN AND SAXAN BEFORE AND AFTER CLOSURE OF A CHEMICAL FACTORY,
Lund Univ. (Sweden). Inst. of Genetics.
G. Fiskesjo.
Ambio, Vol. 14, No. 2, p 99-103, 1985. 5
Tab, 23 Ref.

Descriptors: *Allium test, *Water analysis, *
trial wastes, *Braan, *Saxan, *Sweden, Wat
lution effects, Water quality control, Moni
Herbicides, Phenoxyacetic acids, Phenols, O
compounds, Cytogenetics.

The Allium test has been shown to be helpf
efficient in revealing and evaluating the bio
risks attributable to the water of the river
(Sweden) and the nearby Saxan after the co
nation of the Braan with industrial waste pr
The recovery of the river water after the r
of the source of contamination could also
served with the Allium test. The test is simp
inexpensive and can easily be applied on th
suspicion of contamination. In its simplest
involving only measurements of the root l
after 3-4 days of growth, the test is ideal fo
scanning of water samples in the field. It
applied extensively as a preliminary to m
phisticated methods. Good correlation ha
demonstrated between reduced root grow
presence of microscopic signs of cell poi
Detailed cytogenetic analysis can elucidate
cific types of microscopic aberrations indu
the present case, in which phenoxyacetic ac
phenols were the culprits, the main cyto
aberrations included delayed mitoses and
chromosomes, which are known to be char
tic features of this type of poisoning. The
enced cytogeneticist may often gather v
information about the nature of contaminan
a detailed analysis of cellular responses.
IVI)
W86-00667

**AUTOMATIC WATER QUALITY MON
ING IN RIVERS EXPOSED TO INJU
ACTIVITIES,**
National Board of Waters, Helsinki (Finlan
T. Kohonen.
Aqua Fennica, Vol. 14, No. 2, p 97-127,
Fig, 12 Tab, 30 Ref.

Descriptors: *Water quality, *Monitoring,
*Finland, Water pollution effects, Const
Pulp and paper industry, Wastewater p
Industrial wastes, Water analysis, Automati

Automatic mobile water quality monitor
tions were used to investigate the effects
pulp and paper industry, municipal waste
water regulation and construction work
quality of river water. The variations fou
also examined to determine the need to ch
sampling frequency of manual monitori
frequent automatic monitoring revealed sh
variations and gave more reliable me
ranges than monitoring based on infrequen
sampling. Where extensive data was availa
manual monitoring for the same year or a p
several years, the statistical parameter ca
from the manually and automatically c
data were almost the same. In river wat
heavy loading the choice of monitoring m
dependent on the intended use of the da
possible to obtain adequate data on the
quality of the water by ordinary sam
random intervals. By means of automatic
ing it is possible to examine the effects o
load conditions on the quality of the river
the times which are of greatest sign
(Baker-IVI)
W86-00671

**STATISTICAL MODEL FOR CONVERS
ABSORBANCE MEASUREMENTS WI
NIFICANT IRON INTERFERENCE IN
GANIC CARBON IN A POLYHUMIC**
Helsinki Univ. (Finland). Dept. of Limnol
V. Pennanen, and T. Frisk.
Aqua Fennica, Vol. 14, No. 2, p 171-178
Fig, 2 Tab, 22 Ref.

tors: *Statistical models, *Iron, *Polyhu-
es, *Humic substances, *Color, Absor-
Manganese, Aluminium, Water quality, Ni-
rganic carbon.

al models are presented for taking into
the interference of iron in the conversion
bance values into organic carbon in studies
olor of humic waters. The models were
d for two humic fractions (colloidal and
d) which were separated by gell fractiona-
niques. An assumption was made that the
iron on absorbance was strictly propor-
the iron content of the fraction. There are
terfering substances in absorbance meas-
of humic substances. Among these are
se, aluminium, and nitrate which cause
nces in the optical measurements in the
let and in the visible regions of the spec-
ficients computed on the basis of the data
here cannot be applied to other data sets
general validity has not been tested.
VI)
76

TICAL DETERMINATION OF THE OP-
SAMPLE SIZE OF SECONDARY EF-
BOD5 AND SS,
ental Protection Service, Edmonton (Al-

ental Monitoring and Assessment, Vol.
p 177-183, June, 1985. 2 Fig, 2 Tab, 7 Ref.

rs: *Model studies, *Biochemical oxygen
*Suspended sediments, Statistical models,
ical studies, Water quality control, Moni-

asis of the assumption of random and
nt observations from a long-normal pop-
statistical model for determining the opti-
le size of secondary effluent BOD5 and
en presented. This model is also applica-
on-lognormally distributed effluent vari-
sample size is large. The model can be
plant operator or a regulatory agency to
an effluent monitoring plan for an indi-
unicipal or industrial wastewater treat-
ity, based on actual historical operation
chieve an annual sample geometric mean
in 10% at a 95% confidence level, the
mple sizes for activated sludge effluent
e been found to range, depending on the
of variation, from 40-200 in a year; and
t SS, from 40-225 in a year. In Canada,
vated sludge treatment plants have a
e of less than 40 in a year suggesting
al true geometric means have not been
estimated. (Baker-IVI)

NICITY ASSESSMENT OF DIFFER-
NKING WATER SUPPLIES BEFORE
ER TREATMENTS,
iv. (Italy). Cattedra di Igiene.
, R. Pasquini, and G. S. Sforzolini.
f Environmental Contamination and
, Vol. 34, No. 6, p 815-823, June, 1985.
ef.

: *Mutagenicity, *Drinking water,
lysis, *Water treatment, Water quality,
n, Water distribution, Chlorinated hy-

itatively different raw water supplies
vith their correspondent chlorinated
aters were investigated for their muta-
erties using the Salmonella microsome
inking water supply distributed through
nt types of pipelines was chosen to
effect of the distribution systems on
genicity. A sequential liquid-liquid ex-
hree different pHs and an in situ XAD-
n technique were used to prepare ex-
adsorbates from both untreated and
er samples to compare mutagen recov-
widely used methods. The in situ resin
echnique was unable to recover muta-
ll the water samples, while the liquid-liquid extraction technique gave extracts with mutagenic properties without metabolic activation for the two surface waters only after treatment. The appearance of direct acting mutagens after treatment of surface waters could be due to chlorination steps which allowed the chlorine to react with organic substances producing these potentially harmful compounds. The formation of chlorinated organics could be minimized, for instance, by avoiding prechlorination, chlorine concentrations higher than are necessary or by using alternative disinfectants. The liquid-liquid extraction technique showed higher recovery efficiency of mutagens from water samples. Extraction at different pHs gave useful indications about the chemical class of mutagens. Liquid-liquid extraction at pH 2 and testing of this extract by the Ames test with TA98 and TA100 strains is recommended for routine screening of mutagens in drinking water since acidic extracts contributed the major percentage to the total mutagenicity. (Baker-IVI)
W86-00690

ORGANOCHLORINE RESIDUES IN ANIMALS FROM THREE LOUISIANA WATERSHEDS IN 1978 AND 1979,
Louisiana State Univ., Baton Rouge. Dept. of Entomology.
For primary bibliographic entry see Field 5B.
W86-00691

EVIDENCE FOR POLYNUCLEAR AROMATIC HYDROCARBONS IN THE DIET OF BOTTOM-FEEDING FISH,
Roswell Park Memorial Inst., Buffalo, NY. Dept. of Experimental Biology.
For primary bibliographic entry see Field 5B.
W86-00694

MERCURY DISTRIBUTION IN A POLLUTED MARINE AREA. CONCENTRATIONS OF METHYL MERCURY IN SEDIMENTS AND SOME MARINE ORGANISMS,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
N. Mikac, and M. Picer.
Science of the Total Environment, Vol. 43, No. 1-2, p 27-39, May, 1985. 3 Fig, 4 Tab, 34 Ref.

Descriptors: *Methyl mercury, *Water pollution, *Marine environment, *Sediments, *Marine animals, Kastela Bay, Adriatic Sea, Mercury compounds, Mussels, Fish, Monitoring,.

Methyl mercury concentrations were measured in various parts of Kastela Bay in the Central Adriatic, which is polluted with inorganic mercury. The values obtained, on a wet weight basis, for sediments were from 2 to 20 micro-g methyl mercury/kg; for the mussel Mytilus galloprovincialis from 10 to 110 micro-g/kg; and for various species of fish from 102 to 1448 micro-g/kg. The methyl mercury content increases by three orders of magnitude going from sediment to fish. The distribution of methyl mercury in relation to the depth of the sediment and the different organs of the mussel is presented. On the basis of the results obtained, it may be concluded that non-migratory species of fish are more suitable for methyl mercury monitoring in the marine environment than are sediment and mussels. (Author's abstract)
W86-00707

TESTING FOR THE TOXICITY OF CHEMICALS WITH TETRAHYMENA PYRIFORMIS,
Gifu Coll. of Medical Technology, Seki (Japan). Dept. of Hygiene.
Y. Yoshioka, Y. Ose, and T. Sato.
Science of the Total Environment, Vol. 43, No. 1-2, p 149-157, May, 1985. 5 Fig, 1 Tab, 9 Ref.

Descriptors: *Tetrahymena, *Toxicity, *Bioassay, Protozoa, Partition coefficient, Water analysis.

A test was developed using Tetrahymena pyriformis in order to determine the toxicity of various chemicals. Pre-cultured T. pyriformis was exposed for 24 h at 30 C to various concentrations of chemicals, and the number of T. pyriformis surviving were then counted. The concentration of the chemical, at which the proliferation of T. pyriformis was restricted to one-half of the blank test (EC50), was determined. The method, applied to 57 chemicals, demonstrated that it could be used to detect the chemicals at low concentrations rapidly and with ease. The EC50 values showed a good relationship with 48 h LC50 values for Himedaka (Orizias latipes), and could be explained on the basis of the partition coefficient between water and n-octanol. (Author's abstract)
W86-00711

EFFECTS OF STORAGE ON THE COMPOSITION OF MAIN COMPONENTS IN RAIN-WATER SAMPLES,
Royal Netherlands Meteorological Inst., De Bilt.
For primary bibliographic entry see Field 2K.
W86-00717

WET AND DRY DEPOSITION MONITORING IN SOUTHEASTERN MICHIGAN,
General Motors Research Labs., Warren, MI. Environmental Science Dept.
J. M. Dasch, and S. H. Cadle.
Atmospheric Environment, Vol. 19, No. 5, p 789-796, 1985. 4 Fig, 6 Tab, 11 Ref.

Descriptors: *Monitoring, *Wet deposition, *Dry deposition, *Michigan, Water pollution sources, Air pollution, Rain, Snow, Storms, Seasonal variation, Acid precipitation.

Wet and dry deposition as collected by a bucket were measured at two sites in southeastern Michigan for two years. The precipitation has an average pH of 4.27 and SO4(2-) to NO3(-) ratio of 2.0. Particulate dry deposition velocities of 0.6 cm/s for SO4(2-) and NO3(-) and $>$ 2 cm/s for Cl(-), Ca(2+), Mg(2+), Na(+) and K(+) were calculated. The ambient particle composition, dry bucket collection and wet deposition were compared at two sites, one urban and the other rural. Higher ambient particle concentrations and dry deposition rates were measured at the urban site than the rural site, indicating the influence of local emissions. However, local emissions had no effect on the wet deposition concentrations. The influence of more distant source regions was examined by separating the precipitation events by wind direction. The events from the south and east had the highest SO4(2-) to NO3(-) ratios, which corresponded to the areas with the highest sulfur emissions. NO3(-) showed no directional dependence. Wet deposition was examined for the effect of storm type and seasonal trends. Contrary to a recent study on Long Island, higher concentrations of H(+), SO4(2-) and NH4(+) were found in winter rain compared to snow. The wet deposition concentrations of H(+), SO4(2-), and NH4(+) were highest in the summer, while only Na(+) and Cl(-) concentrations were highest in the winter, presumably due to winter road salting. The total deposition of acidic ions was highest in the summer and lowest in the winter, due both to low concentrations and lower precipitation volumes in the winter. The dry deposition as collected by a bucket accounted for 1% of total H(+) deposition, 21% of SO4(2-) deposition, 27% of NO3(-) deposition, 50% of Cl(-) deposition and 61% of Ca(2+) deposition. (Author's abstract)
W86-00719

USE OF WATERSHED CHARACTERISTICS TO SELECT CONTROL STREAMS FOR ESTIMATING EFFECTS OF METAL MINING WASTES ON EXTENSIVELY DISTURBED STREAMS,
Illinois Univ. at Urbana-Champaign. Dept. of Ecology, Ethology and Evolution.
For primary bibliographic entry see Field 5C.
W86-00725

AQUATIC BIOASSAY OF 11 PESTICIDES USING LARVAE OF THE MOSQUITO, WYEOMYIA SMITHII (DIPTERA: CULICIDAE),
Air Force Occupational and Environmental Health Lab., Brooks AFB, TX.

D. Strickman.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 1, p 133-142, July, 1985. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Pitcher plants, *Mosquitos, *Pesticides, *Larvae, *Bioassay, Assay, Toxicity, Water pollution effects, DDT, Heptachlor epoxide, Chloropyrifos, Malathion, Temephos, Carbaryl, Methomyl, Propoxur, Permethrin, Phenothrin, Resmethrin, Animal behavior.

The sensitivity of the pitcher plant mosquito assay to 11 pesticides representing four widely used groups was established; the assay detected the pesticides in water samples at levels within the ranges approximating with lethal concentrations of several fish species. The lowest concentrations of each pesticide affecting survival and development of larvae, respectively, were as follows (ppb): DDT (50, 50), heptachlor epoxide (10, 5), chlorpyrifos (1, 1), malathion (100, 100), temephos (5, 5), carbaryl (1,000, 1,000), methomyl (5,000, 1,000), propoxur (1,000, 500), permethrin (5, 1), phenothrin (20, 10), and resmethrin (100, 50). In many cases the lowest concentration detected was the lowest concentration used in the assay. The bioassay lasted for 7 days, and effects typically appeared between days 2 and 4. Behavioral signs of intoxication by pesticides included uncoordinated movement, jerky movement, difficulty unflexing, inactivity, and tonic contraction of longitudinal muscles resulting in shortening and thickening of larvae. All toxicants tested caused some or all of these signs, but consistent differences in signs were evident among pesticides, suggesting the possibility of using this assay in identification of pesticide contaminants. (Rochester-IVI)
W86-00733

ION CHROMATOGRAPH PROVIDES RAPID ANALYSIS OF AIR AND WATER,
P. Pecevich.
Pollution Engineering, Vol. 17, No. 3, p 53-55, March, 1985. 1 Fig, 1 Tab.

Descriptors: *Ion chromatography, *Water analysis, *Chromatography, Acid rain, Seawater, Iron, Cobalt, Nickel, Copper, Metals.

Ion chromatography easily measures several ions in a single analysis, and can measure trace amounts of one ion in the presence of large concentrations of other ions. This liquid chromatographic technique utilizes ion exchange resins as the means of separation and uses conductivity for detection and analysis of anions and cations. Because of its high degree of accuracy and reliability, ion chromatography has been designated by the Environmental Protection Agency (USA) as the method of choice for the analysis of acid rain. The ability of ion chromatography to resolve low concentrations of one or several inorganic anions in the presence of high concentrations of other inorganic ions makes it an ideal tool for the analysis of pollutants in sea water. Ion chromatography provides a fast, reliable, and accurate technique to monitor potential pollutants, such as iron, copper, nickel, and cobalt in industrial process wastes, prior to discharge into the environment, or to analyze samples from contaminated areas. A complete anion and cation profile can be obtained in less than 20 min with low ppb detection limits. (Rochester-IVI)
W86-00768

SORPTIVE CAPACITY OF AN AQUATIC MACROPHYTE FOR THE PESTICIDE AMINOCARB,
Ottawa Univ. (Ontario). Dept. of Biology.
P. Weinberger, and R. Greenhalgh.
Journal of Environmental Science and Health, Vol. B20, No. 2, p 263-273, April, 1985. 2 Fig, 14 Ref. NSERC grants GO-204 and A1737.

Descriptors: *Sorption, *Macrophytes, *Aminocarb, *Insecticides, *Hornwort, Aquatic plants, Pesticides, Water pollution effects, Fate of pollutants.

Hornwort (Ceratophyllum demersum) was exposed to a constant 1 micro-g/ml aminocarb concentration for an experimental period of 300-450 h. The concentration of aminocarb in the plant tissue and surrounding water was constantly monitored. Hornwort exhibited a large capacity for the sorption of the pesticide - up to 400 micro-g/g fresh weight in the dark and 1000 micro-g/g fresh weight in the light. Smaller, actively growing sprigs sorbed 5 times more pesticide per gm fresh weight than larger, older sprigs, although total uptake per plant was greater in the larger plants. Incipient necrosis became evident in treated plants after 72 h in the dark and after 312 h in the light while untreated controls remained healthy for the entire period. In living plants, light was a significant factor in increasing the sortptive capacity of the plant. Younger sprigs, with a higher ratio of lear sorptive surface to internodal stem per g fresh wt, provided the largest sink for the pesticide. Membrane conformation and integrity appear to be important factors in determining the capacity of this aquatic plant for pesticide sorption. Because of its large sorptive capacity, Hornwort may provide a good non-target species for monitoring residual pesticides in an aquatic environment. (Collier-IVI)
W86-00812

SULFATE DETERMINATION IN INDUSTRIAL WASTEWATER BY LIQUID CHROMATOGRAPHY WITH POSTCOLUMN SOLID-PHASE REACTION DETECTION,
Proefstation voor Aardappelverwerking, Groingen
K. Brunt.
Analytical Chemistry, Vol. 57, No. 7, p 1338-1341, June, 1985. 4 Fig, 5 Tab, 19 Ref.

Descriptors: *Sulfates, *Industrial wastewater, *Liquid chromatography, *Reaction detection, Potato starch industry, Pollutant identification, Chemical analysis, Chromatography.

A sulfate selective postcolumn solid-phase reactor (SPR) detection system is described for sulfate determination at parts per million (ppm) levels in potato starch industry wastewaters. The effect of the chromatographic flow rate on the conversion reaction in the SPR is discussed. The linear dynamic range of the detection system in combination with the used anion-exchange separation is from about 5 to 400 ppm. The repeatability of the system at the 30 ppm sulfate level is better than 3.5%. The SPR system can be used for about 13 h without noticeable depletion effects. Day-to-day repeatability is good. Application of the described detection system for the sulfate determination industrial wastewaters is discussed. Recoveries in spiked wastewater samples were better than 90%. (Author's abstract)
W86-00819

EXTRACTION AND ENRICHMENT OF CHLORINATED PHENOLS FROM SURFACE WATERS FOR THE DETERMINATION BY CAPILLARY-GC/FTIR-SPECTROSCOPY,
Johannes Kepler Univ., Linz (Austria).
H. Malissa Jr., G. Szolgyenyi, and K. Winsauer.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 321, No. 1, p 17-26, May, 1985. 5 Fig, 3 Tab, 48 Ref. Osterreichischr Fonds zur Forderung der wissenschaftlichen Forschung grant 4807.

Descriptors: *Water analysis, *Chlorinated phenols, *Fourier-transform infrared spectroscopy, *Gas chromatography, Chromatography, Spectroscopy, Phenols.

A method is presented for the separation and substance-specific determination of chlorinated phenols at trace level in surface waters using capillary-GC/FTIR-spectroscopy. Since an injected amount of at least 100 ng is required to obtain well-structured IR spectra, the extraction and enrichment procedure must provide a concentration factor of 10,000 and simultaneously high recoveries. The separation of the complete range of chlorinated phenols was performed without derivatization on a SE54 fused silica WCOT column; the degree of decrease in separation efficiency introduced by the FTIRS detection system is discussed. The applicability of an on-column injection technique using a thermodesorption-and cold trap injector with solvent removal was tested, which allows the injection of large volumes of concentrate Pro
from 1 l water volume and a 10 ppb conce
level the chlorophenols were correctly id
by their IR spectra; mean recovery was in t
range The possibility of obtaining informa
the identity of matrix components based on
only is discussed. (Author's abstract)
W86-00824

**SEPARATION AND DETERMINATIO
SELENIUM(IV) IN ENVIRONM
WATER SAMPLES BY AN ANI
CHANGE RESIN MODIFIED WITH
MUTHIOL-II AND DIAMINONAPHTH
FLUOROPHOTOMETRY,**
Nagoya City Environmental Pollution R
Inst. (Japan).
K. Itoh, M. Nakayama, M. Chikuma, and H
Tanaka.
Fresenius's Zeitschrift fur Analytische
Vol. 321, No. 1, p 56-60, May, 1985. 5 Fig,
Ref.

Descriptors: *Selenium, *Anion-exchange
*Bismuthiol-II, Diaminonaphthalene fluor
metry, *Resins, *Water analysis, Chemica
sis, Metals, Fluorometry, Tellurium cop
tion.

Selenium(IV) in environmental water samp
determined fluorometrically following its
tion by the use of a new functional resin. T
was easily prepared from an anion-exchan
by modification with bismuthiol II. Th
method comprises a combination of the pre
tration with bis II resin and the convention
ometry with 2,3-diaminonaphthalene-cycl
(DAN). A highly selective adsorpt
selenium(IV) was achieved by the form
stable selenotrisulfide from bismuthiol
selenium(IV) on the resin. The method
cessfully employed for the determination
river water and waste water. The adsor
selenium(IV) on bis II resin is hardly affe
organic compounds; the tellurium coprec
method with ascorbic acid is affected by
compounds. The method is advantageous
treatment of environmental samples in
because selenium can be collected on the
adsorbed selenium is very stable and can b
for determination in the laboratory. (Col
W86-00825

**EXTENT OF MONOCHLORAMINE
FERENCE IN THE DPD COLORIN
METHOD FOR FREE CHLORINE IN
Paris-5 Univ. (France). Lab. d'Hydrologie.
N. Strupler.
Journal of the Institution of Water Engin
Scientists, Vol. 39, No. 2, p 134-136, April
Fig, 2 Tab, 4 Ref.

Descriptors: *Monochloramine, *Diethyl
ylene-diamine, *Colorimetry, *Chlorine, C
analysis, Water analysis, Reagents, Iodome

If standard procedures are followed, that is
ing free available chlorine (FAC) readings
a standing period, preferably well withi
coupled wth strict adherence with appro
gent specifications, the interference by
monochloramine normally encountered
insignificant. Diethyl-p-phenylene-diamine
results in this way compared favorably wi
minations by iodometry. At 21 C, positi
errors of 2.6% of the monochloramine co
tion per minute were observed when stan
gents were used. In a comparison of
reagents with non-standard reagents whic
interference suppressing agents, the non
agents gave considerably larger appare
readings (4.0-9.0% of initial monochloram
tent). When 1 minute was allowed to ela
adding reagents before taking readings,
ochloramine interference for standard reag
1.3% at 10 C, 2.6% at 19/20 C, and 3.3 a
terms of initial monochloramine conce
(Rochester-IVI)
W86-00833

USE OF DISSOLVED OXYGEN ELEC-
CS,
n Illinois Univ. at Carbondale. Dept. of
phy.
rowse.
of Institution of Water Engineers and Sci-
Vol. 39, No. 2, p 179-183, April, 1985. 1
Ref.

ors: *Dissolved oxygen, *Electrodes,
sts, Nomograms, Calibrations, Mathemati-
ions, Measuring instruments, Water analy-

a recent three year study of urban storm
uality, which involved sampling waters
avily polluted or charged with organic
d solids, a membrane oxygen electrode
r were employed for field determinations.
e and meter both performed well but two
were identified: There is a measure of
ty as to which of several calibration
were most appropriate to field-use; and,
n procedures need improvement. Calibra-
edures need to be standardized and more
valuated, to maintain instrument precision
comparability. More rapid and conven-
lation procedures are required to obviate
for commonly used nomograms. A math-
relationship was derived to undertake the
n to mg/l. For all practical purposes, the
obviates the need for the nomogram over
ange of dissolved oxygen concentrations
be encountered in natural fresh waters.
tion allows the use of pocket calulators
se or the use of a main-frame computer in
primary data may be stored and conver-
be programmed. Although modified
methods most accurately determine dis-
ygen levels in water in the laboratory,
retain the advantages of field portabil-
ity of use and insensitivity to interfer-
llier-IVI)
7

ADSORPTION ISOTHERM TEST
LATILE ORGANIC CHEMICALS IN

neiter, J. Dragun, and T. W. Kalinowski.
the Water Pollution Control Federation,
o. 5, p 403-405, May, 1985. 1 Fig, 1 Tab,

s: *Organic compounds, *Volatile com-
Carbon adsorption isotherm test, Water
ctivated carbon, Isotherms.

l is presented for conducting batch iso-
with mixtures of volatile organic com-
water in such a way as to account for
sses from volatilization. Several impor-
fications to the ASTM standard were
to control and measure volatilization
follows: (1) the activated carbon mass
timated from pure solute isotherm data,
the anticipated range of carbon effec-
sed on known raw water quality, (2)
filled glass bottles with airtight, teflon-
are substituted for stoppered flasks, (3)
agitated for 24 hr instead of 2 hr, (4)
not filtered; a minimum of 4 hr settling
tration, and (5) sample controls are used
volatilization losses. This protocol has
as a preliminary step in actual ground-
edial action projects where design of
ctivated carbon absorption equipment
valuated. Isotherms for individual, key
ts or for aggregates of multiple con-
ave been prepared to evaluate carbon
effectiveness and to compare different
further study or application. (Roches-

RM TEST FOR PREDICTING THE
L OF XENOBIOTICS TO IMPAIR
CTIVE SUCCESS IN FISH,
nvironmental Research Inst., Stock-

A. H. Neilson, L. Sorensen, A.
nd T. Viktor.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, p 282-293, June, 1985. 6 Fig, 2 Tab, 21 Ref.

Descriptors: *Bioassay, *Fish, *Toxicity, *Reproduction, Anadromous fish, Fish migration, Spawning, Immature growth stages, Water pollution effects, Mortality, Hatching, Zebra fish.

Short-term screening tests with the zebra fish (Brachydanio rerio) have been developed for predicting the potential of xenobiotics to impair reproductive success in fish. The aim was to find simple and sensitive test parameters and to simulate exposure situations typical for anadromous fish species (salmonids), which generally cross heavily polluted coastal areas or estuaries before they reach uncontaminated upstream spawning areas. Therefore, particular attention was directed to tests designed to assess adverse effects induced during gametogenesis in adult fish. The test protocol involves exposure of adults prior to, but not during, spawning and the effects are measured in the offspring as alterations in hatching frequency and hatching rate of eggs, and survival and stress tolerance of embryos and larvae. Some representative examples of the application of these tests are given, and it is some that impairment of reproductive success can be induced by exposure of parent fish prior to spawning at concentrations of xenobiotics at least five times lower than those yielding effects during exposure of embryos and larvae. It is suggested that, in hazard assessment programs, tests of the effect of xenobiotics on the offspring of preexposed adults be routinely incorporated. (Author's abstract)
W86-00874

5B. Sources Of Pollution

MODEL OF SULPHATE CONCENTRATION IN A SMALL STREAM IN THE HARP LAKE CATCHMENT, ONTARIO,
Oslo Univ. (Norway). Dept. of Chemistry.
H. M. Seip, R. Seip, P. J. Dillon, and E. de Grosbois.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 5, p 927-937, May, 1985. 4 Fig, 3 Tab, 28 Ref.

Descriptors: *Sulfates, *Streams, *Mathematical models, *Acid rain, *Harp Lake Catchment, *Ontario, Soil chemistry, Oxidation, Solubility, Snowmelt, Catchment area, Sulfur.

The causes of the recent acidification of surface waters in several parts of the world are still a matter of considerable controversy. A better understanding of the acidification mechanisms can be obtained by a combination of field studies and mathematical modelling. A complete model would require very extensive information about the catchment (e.g. precipitation, water chemistry, soil chemistry, vegetation). Very few, if any, data sets in existence satisfy these requirements. A model previously used for Norwegian catchments was modified to predict discharge and sulfur concentration in a stream draining a small catchment in Ontario. The annual input of sulfur roughly balances the output, the average sulfur flux being about 1.6 g S/sq m/yr. The average dry deposition was estimated to be about 0.4 g S/sq m/yr. For good agreement between calculated and observed sulfur concentrations, it was necessary to introduce a reduction (or adsorption) process for sulfate in deeper soil layers during summer and fall. During dry periods, however, sulfate is produced by oxidation in the upper soil layer. The sulfate concentrations in streamwater during snowmelt are remarkably constant. According to model results this could be explained by the existence of a reservoir of easily soluble sulfur in the soil considerably larger than the annual sulfur flux. The basic structure of the models applied to the Ontario stream and to two streams in Norway was the same. It seems likely, therefore, that the model may, with moderate modifications, be applicable to many catchments. (Author's abstract)
W86-00629

CHEMICAL STUDY OF THE SHOHOLA CREEK HEADWATERS, PIKE COUNTY, PENNSYLVANIA,
East Stroudsburg Univ., PA. Dept. of Chemistry.
R. Davis, and C. Y. Cheng.
Proceedings of the Pennsylvania Academy of Science, Vol. 58, No. 2, p 202-206, 1984. 6 Fig, 1 Tab, 8 Ref.

Descriptors: *Shohola Creek, *Pike County, *Pennsylvania, *Chemical analysis, Water analysis, Alkalinity, Hardness, Water properties, Highways.

Factors that contribute to the overall inorganic water quality and the possible effects of Interstate 84 which lies near the Shohola Creek were investigated. The Shohola Creek is located in southeastern Pike County in northeastern Pennsylvania. It is a spring fed creek that starts in the woods and flows into the Delaware River at Shohola. The chemical analyses of the waters revealed a pH which decreased from a high of 7.41 to a low of 6.76 over the test period while the alkalinity shows a gradual increase. Hardness, phosphate-phosphorus, and nitrate-nitrogen showed similar increases. Manganese and iron concentrations were very low and the lead concentrations were almost all negligibly low. During the test period the overall inorganic water quality seemed not be affected by the heavy traffic on Interstate 84, which lies nearby. (Baker-IVI)
W86-00636

USING SIMULATION TO ASSESS THE IMPACTS OF CONSERVATION TILLAGE ON MOVEMENT OF SEDIMENT AND PHOSPHORUS INTO LAKE ERIE,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W86-00650

STUDIES OF WATER POLLUTION OF THE RIVER CAUVERY - PHYSICO-CHEMICAL CHARACTERISTICS,
Bangalore Univ. (India). Dept. of Botany.
R. K. Somashekar.
International Journal of Environmental Studies, Vol. 24, No. 2, p 115-123, 1985. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Water analysis, *River Cauvery, *India, *Physicochemical characteristics, Seasonal variations, Anions, Cations, Agricultural chemicals, Fate of pollutants, Water pollution.

An attempt was made to understand the chemical characteristics of surface waters of the river Cauvery and to correlate the chemical concentration and loads in the river as a function of hydrological parameter, viz. water discharge. Water samples from the river Cauvery, Karnataka, India were collected from three stations located over a distance of 20 km: Station 1 was near Krishnarajasagar dam; Station 2 was located at the point of discharge of effluents from paper and fertilizer factories; Station 3 was located near the confluence of the Cauvery and Kapila rivers. Monthly and seasonal variations in major cations and anions were significant. The regression analysis of transported ions, silica and alkalinity varied with the quantity of river flow and yielded a linear relationship. The transported dissolved load of chemical constituents increased with the discharge, but the concentrations of all the constituents, except silica, calcium and iron, were inversely correlated with the stream discharge at all the stations. The rate of increase of the dissolved load with river discharge is slower for the constituents which are inversely related to discharge, with a significant negative correlation index. The sources of dissolved chemical constituents in the river water of all three stations are most likely the weathering of rocks, minerals and soils in the catchment area. The addition of water from the nearby agricultural fields and of domestic wastes are responsible for variations in some of the parameters, especially at station 2. A short-term investigation into the hydrology of the river water can demonstrate the general trends that exist in the area. (Baker-IVI)

W86-00657

ANALYSIS OF PRECIPITATION CHEMISTRY DATA FROM ALASKA,
National Oceanic and Atmospheric Administration, Rockville, MD. Air Resources Lab.
For primary bibliographic entry see Field 2K.
W86-00659

ACIDIFICATION OF SOUTHERN APPALACHIAN LAKES,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
R. W. Talbot, and A. W. Elzerman.
Environmental Science and Technology, Vol. 19, No. 6, p 552-557, June, 1985. 2 Fig, 2 Tab, 21 Ref. Department of the Interior grant B-151-SC and NSF grant ISP-8011451.

Descriptors: *Acidification, *Lakes, *Appalachians, *Acid rain, Atmospheric deposition, Chemical properties, Alkalinity, Watersheds, Soil chemistry, Weathering, Reservoirs.

Measurements of the dissolved (< 0.4 micro-m) major element water chemistry of 10 lakes and reservoirs situated in the southern Appalachian Mountain and Carolina Peidmont regions are used to examine effects of acidic atmospheric deposition inputs on water chemistry. In the mountain region, lakes with low alkalinity and a small watershed/lake area ratio appear to be most susceptible to, and may be undergoing, pH reduction. In the Piedmont region, watershed soils, especially those exposed by man's activities, appear to be effectively neutralizing acid inputs. Weathering of rocks and soils accelerated beyond that expected from carbonic acid alone is probably occurring in the mountain and Piedmont systems. The analysis suggests that reduction of lake water pH, mobilization of soil chemical constituents, and subsequent changes in the chemical composition of aquatic systems may be a more widespread and potentially serious environmental problem in this area than previous analyses have suggested. (Author's abstract)
W86-00663

FATE AND EFFECTS OF ORGANOTIN COMPOUNDS,
California Univ., Berkeley. Dept. of Zoology.
R. B. Laughlin, and O. Linden.
Ambio, Vol. 14, No. 2, p 88-94, 1985. 8 Fig, 60 Ref.

Descriptors: *Fate of pollutants, *Organotin compounds, *Tin compounds, Organic compounds, Toxicity, Bioaccumulation, Antifouling paints, Water pollution effects.

The increasing use of organotin compounds may produce environmental problems of both magnitude and duration. At present, additional data are needed to predict with confidence the possible environmental effects posed by these compounds. This review showed that while knowledge is advancing rapidly, there remain serious gaps. In particular, the difficulty of chemical analyses of these compounds poses problems answering questions about biological effects. Nevertheless, it is clear that early information about their lack of toxicity, mode of action and rapid rate of degradation in the environment is inaccurate or only partially correct. Given the enormous number of potential chemical structures possible, modern structure-toxicity quantification is being studied. This information, it is hoped, may be used prior to the appearance of problems. Bioaccumulation potential, as indicated by octanol-water partition coefficients, is large and may prove particularly detrimental to nearshore seafood resources. The use of effective copolymer antifouling paints with low triorganotin release rates is to be encouraged to minimize these problems. Efforts to monitor and control effluents should take into account not only primary constituents, but also redistribution products and impurities since they, proportionally, may be present in low but acutely toxic concentrations. It will only be by prudent use that the benefits of organotins will be maximized and risks minimized. (Baker-IVI)

W86-00665

POTENTIALLY TOXIC BLUE-GREEN ALGAE (CYANOBACTERIA) IN FINNISH NATURAL WATERS,
Helsinki Univ. (Finland). Dept. of Limnology.
P.-E. Persson, K. Sivonen, J. Keto, K. Kononen, and M. Niemi.
Aqua Fennica, Vol. 14, No. 2, p 147-154, 1984. 1 Fig, 7 Tab, 33 Ref.

Descriptors: *Cyanophyta, *Toxins, *Finland, *Coastal waters, Lakes, Toxicity, Phytoplankton, Eutrophication, Water pollution sources.

Blue-green algal blooms in natural waters may result in severe ecological and practical problems, as several species of blue-green algae are capable of producing toxins. The occurrence of potentially toxic blue-green algae in Finland was examined. The survey was restricted to species associated with acute cases of poisoning, typical of exotoxins (hepatotoxins, neurotoxins). The number of samples on record was 5288. Thirteen percent of the samples from freshwaters and one third of the samples from coastal waters contained noteworthy concentrations of potentially toxic blue-green algae. A case of dog poisoning is also reported which resembled the outbreaks in Denmark and Sweden in 1975 and 1982, respectively. The existence of a toxic blue-green algal strain in Lake Vesijarvi is also noted. (Baker-IVI)
W86-00674

POLLUTION LOADINGS FROM FINNISH INLAND FISH-FARMS: A CASE STUDY,
Kuopio Univ. (Finland). Dept. of Occupational and Industrial Hygiene.
E. Parjala, A. Tamminen, and O. V. Lindqvist.
Aqua Fennica, Vol. 14, No. 2, p 205-214, 1984. 13 Fig, 2 Tab, 22 Ref.

Descriptors: *Water pollution sources, *Fish farming, *Finland, Nitrogen, Phosphorus, Phosphates, Aquaculture, Pollution load, Suspended solids, Sludge, Fate of pollutants.

Pollution loadings were studied from a fish-farm in Central Finland producing annually about 200 tons of rainbow trout. The farm has 34 separate ponds with total surface area of 55,800 sq m. Average depth of the ponds and raceways is about one meter. The retention time of the water at the farm was 5 to 8.5 hours. The farm used 25-30% of the water flow of the nearby river. The effluents on the farm had total phosphorus concentrations of 34-120 micro-g/l, total nitrogen concentration of 580-1300 micrg-g/l, suspended solids concentration of 1-9 mg/l and BOD7 of 2.3-5.1 mg oxygen/l. Pollution loadings of the farm were 9.0 to 20.5 gP/kg of fish, 6.0-9.7 gP/kg of feed, 48-108 gN/kg of fish, 26-170 gN/kg of feed, 3.1-19.4 gSS/kg of fish, 5.2-19.5 gSS/kg of feed, 0.2-0.7 g BOD/kg of fish and 0.4-1.1 g BOD/kg of feed. More than 50% of the total phosphorus and more than 70% of the nitrogen in the effluents was soluble. Almost all the phosphorus loading caused by the farm consisted of phosphate-P. The main part of the nitrogen loading consisted of ammonia-N and organic nitrogen compounds. Phosphorus and nitrogen leach very quickly and effectively from the sludge which gathers on the bottom of the raceways. The sludge should be removed once or twice a week from the bottom of the raceways to effectively decrease phosphorus and nitrogen loadings. (Baker-IVI)
W86-00680

MERCURY CYCLE IN LAKES; SOME NEW HYPOTHESES,
National Board of Waters, Helsinki (Finland). Water Research Inst.
M. Verta.
Aqua Fennica, Vol. 14, No. 2, p 215-221, 1984. 3 Fig, 3 Tab, 51 Ref.

Descriptors: *Mercury, *Fate of pollutants, *Organomercury compounds, *Fish physiology, *Bioaccumulation, Temperature effects, Water quality, Acidity, Bacteria, Heavy metals, Metals.

Factors influencing the content of methyl
in freshwater biota can be listed as the ar
methyl mercury to which the organism is
and factors which affect the methylation o
ry or the accumulation of methyl mercury
such as temperature, water quality, bacteri
ty, size, age, sex, and metabolic differenc
the mercury content of freshwater biot
greatly between individuals of a single
from different environments, even if th
subjected to the same level of contamina
study of 35 forest lakes the methyl merc
tent in pike was correlated better with t
quality parameters describing the allochto
ganic matter content in the lake than with
trophic level. In a typical freshwater la
than 90% of the mercury that can be m
and can enter the food chain is in the up
cm of the bottom sediments and only abo
in the fish population. Once assimilated
methyl mercury is bound very strongly
tissues. When a fish is eaten by a predator
assimilation efficiency for naturally acc
methyl mercury is only 10-20%. Mos
methyl mercury eaten is excreted in feces
the fish population contains such a large fr
the total amount of methyl mercury, inten
ing can effectively decrease the amount o
mercury cycling in lake biota. This coul
the decrease of methyl mercury concentr
fish if the fish population reacts to fish
more rapid growth. Whatever the impact
on the methyl mercury concentration of
evident that only with quantitative estim
methyl mercury amounts in biota, especia
populations, can an understanding be gain
mercury cycle in lakes. (Baker-IVI)
W86-00681

**QUALITY OF RUNOFF WATER FRO
ISH FUEL PEAT MINING AREAS,**
Helsinki Univ. (Finland). Dept. of Limnol
T. Sallantaus.
Aqua Fennica, Vol. 14, No. 2, p 223-23
Fig, 4 Tab, 22 Ref.

Descriptors: *Water pollution source
*Mining, *Drainage, Acidity, Water qua
pended sediments, Chemical oxygen den
ganic carbon, Bogs, Mires.

A fuel peat mining area with well de
peat exposed at the surface is susceptib
sion. This must be taken into account w
ning the peat mining area and measures
ing the loading of watercourses due to pe
The great volume of ditch network shoul
as short time storage for runoff water af
rains to promote settling of suspended s
could be achieved by constructions in
ditches, which automatically dam wate
certain runoff rate is reached. The effec
constructions depends greatly on the slop
ditches and lower parts of field ditches
construction. These construction should
mented by sedimentation basins, which
situated before mixing with waters fro
the peat mining area takes place, either i
ditches or at the end of each field d
quantitative changes in the discharge of
organic matter due to peat mining se
rather small once the depletion of wat
after drainage has taken place. More
should be paid to qualitative changes. T
of runoff waters from oligotropic peatla
to be reduced in many cases after dra
peat mining and it seems that neutral
drainage waters, as has sometimes been
is not normally needed. (Baker-IVI)
W86-00682

**DISTRIBUTION OF HEAVY ME
WATER AND SEDIMENTS OF SI
SITES OF YAMUNA RIVER (INDI
RONMENTAL MONITORING O
YAMUNA RIVER - PART I,**
Aligarh Muslim Univ. (India). Environ
search Lab.
M. Ajmal, M. A. Khan, and A. A. Noma
Environmental Monitoring and Assess

2, p 205-214, June, 1985. 1 Fig, 3 Tab, 34

ptors: *Yamuna River, *India, *Metals, ents, *Water pollution, Water analysis, Car-, Copper, Cadmium, Chromium, Iron, ese, Nickel, Lead, Zinc, Phosphorus, In- wastes, Domestic wastes, Pesticides.

pact of domestic and industrial effluents on centrations of Cd, Cu, Co, Cr, Fe, Mn, Ni, Zn metals in water and sediments of the river was studied at various sampling The mechanism of sedimentation of metals organic matter, calcium carbonate, and also considered. This study covers a dis- about 840 km and five big cities, namely Mathura, Agra, Etawah, and Allahabad. n in the concentrations of the elements e sampling station to another may be due variation in the quality of industrial and wastes being added to the water at differ- its. Sediments of the Yamuna river con- 1-5.2% calcium carbonate, a high quantity. cipitation of a number of metals in the of such a high carbonate concentration is The highest concentrations of iron and se in the sediments were detected at Agra hura, 8387.0-9636.0 micro-g/g and 521.0- cro-g/g, respectively. At Agra a number oundries are situated which directly inject uents into the river. Chromium and nickel rom 8.60-199.35 micro-g/g and 4.72-39.5 g, respectively. Maximum chromium was Mathura and maximum nickel values at he amount of organic matter was highest ollowed by Delhi and Mathura, probably e high organic pollution by sewage and organic pollutants disposed off from es. Phosphorus was in the range of 290.0- /kg in the river sediments. This high level ue to the cremation of dead bodies on the he river and throwing of the ashes into it. reason may be the excessive use of organ- rus pesticides which utimately reach the ugh runoff. (Baker-IVI)
5

EPOSITION IN ACID LAKES: THE F DIFFUSION,
National de la Recherche Scientifique, y (Quebec).
an, and A. Tessier.
Vol. 228, No. 4707, p 1524-1526, June, g, 2 Tab, 23 Ref.

rs: *Zinc, *Diffusion, *Acid lakes, *Sedi- r interfaces, *Lake sediments, *Clearwa- *Ontario, *Tantare Lake, *Quebec, tals, Lakes, Acidity, Fate of pollutants.

ve importance of the diffusion mecha- een investigated in two lakes by compar- esent-day rates of zinc accumulation to ated diffusive fluxes across the sediment rface. Duplicate sediment cores were t a depth of 20.2 m in Clearwater Lake, d at 15.5 m in Tantare Lake, Quebec. ent Zn(t) profiles show a maximum at cm, with a nearly linear decrease to a evel at 9 to 10 cm. Such profiles are n acid lakes. In Tantare Lake, a recent sediment deposition is very unlikely as watershed has not been disturbed by road construction, or wood harvesting the last 100 years. In Clearwater Lake, leposition may have recently increased he extensive deforestation of the water- 50 years ago from smelter sulfur dioxide The transport of trace metals from the mn to the sediments has generally been s a sedimentation process controlled by of trace metal association to the sus- ids and by the rate of sedimentation of ded solids. Present results suggest that el may not be applicable for zinc in acid perhaps for other elements that are the water column in relatively high ons but are efficiently scavenged in the Because of the nonsteady state nature of nic zinc influx in lakes, it may be advis- nonsteady-state numerical methods in the interpretation of sedimentary zinc profiles and in the modeling of the early diagenesis of this element and other transition metals in acid lakes. (Baker-IVI)
W86-00689

ORGANOCHLORINE RESIDUES IN ANIMALS FROM THREE LOUISIANA WATERSHEDS IN 1978 AND 1979,
Louisiana State Univ., Baton Rouge. Dept. of Entomology.
P. F. Dowd, G. U. Mayfield, D. P. Coulon, J. B. Graves, and J. D. Newsom.
Bulletin of Environmental Contamination and Toxicology, Vol. 34, No. 6, p 832-841, June, 1985. 6 Tab, 7 Ref. U.S. Department of the Interior, Patuxent Wildlife Research Center contract 14-16-0009-77-950.

Descriptors: *Chlorinated hydrocarbons, *Louisiana, *Lake Verret, *East Franklin, *Bayou Plaquemine-Brule, *Pesticides, *Water pollution effects, *Animal tissues, Fate of pollutants, Fish, Crustaceans, Mammals, Birds, Insecticides, Heron, Raccoons, Shad, Catfish, Crappie, Frogs, Crawfish, Benzene hexachloride, Chlordane, Compound E, DDD, DDT, DDE, Dieldrin, Endrin, Heptachlor, Polychlorinated biphenyls, Nonachlor, Toxaphene.

Organochlorine pesticide residues were detected in some, but not all, samples of animal tissue obtained three sites in Louisiana. The sites reflected different levels of pesticide use: East Franklin, formerly heavy organochlorine insecticide use; Bayou Plaquemine-Brule, intermediate insecticide use; and Lake Verret, low insecticide use. Samples of yellow-crowned night heron (Nyctanassa violacea) water snakes (Natrix spp.), raccoons (Procyon lotor), shad (Dorosoma spp.), channel catfish (Ictalurus punctatus), crappie (Pomoxis spp.), frogs (Rana spp.) and crawfish (Procambarus clarkii) were obtained in 1978 and 1979. Chromatographic methods were used for detection of alpha- and beta-benzene hexachloride, alpha- and gamma-chlordane, compound E, DDD, DDE, DDT, dieldrin, endrin, heptachlor, polychlorinated biphenyls (PCBs) trans- and cis-nonachlor, and toxaphene. The compounds most frequently found as residues in catfish whole body, crappie, shad, and heron were DDE, dieldrin, and PCBs in samples from the Lake Verret site. DDE and dieldrin generally declined from 1978 to 1979, but levels of PCBs stayed approximately the same or increased during this period. The compounds most frequently encountered as residues in samples from catfish whole body, heron, shad, crappie, crawfish, and snakes at the Plaquemine-Brule site were chlordane isomers, DDE, and PCBs. While DDE and chlordane tended to decline from 1978-1979, PCBs remained the same or increased. At the East Franklin site, residues from catfish whole body, crappie, heron, and shad primarily consisted of DDE and PCBs, except for shad, which had residues of several compounds in 1978. DDE levels declined in all types of samples except shad from 1978 to 1979; PCBs remained fairly constant. Heron and shad are apparently the species most likely to accumulate organochlorine residues, regardless of contamination level at the site of collection, which allows them to serve as indicator species for organochlorine contamination in Louisiana. (Rochester-IVI)
W86-00691

METABOLISM OF ALDRIN BY THE FRESHWATER PLANARIAN PHAGOCATA GRACILIS,
Middle Tennessee State Univ., Murfreesboro. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-00693

EVIDENCE FOR POLYNUCLEAR AROMATIC HYDROCARBONS IN THE DIET OF BOTTOM-FEEDING FISH,
Roswell Park Memorial Inst., Buffalo, NY. Dept. of Experimental Biology.
A. E. Maccubbin, P. Black, L. Trzeciak, and J. J. Black.
Bulletin of Environmental Contamination and Toxicology, Vol. 34, No. 6, p 876-882, June, 1985. 3 Fig, 2 Tab, 17 Ref.

Descriptors: *Fish, *Polynuclear aromatic hydrocarbons, *Fish food, *Stomachs, *Lake Erie, Hydrocarbons, Suckers, Fluoranthene, Sediments, Flourene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzanthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, benzo(g,h,i)perylene, indeno(1,2,3-c,d)pyrene.

High Pressure liquid chromatography studies of stomach contents of white suckers (Catastomus commersoni) collected at three sites in eastern Lake Erie (USA) demonstrated the presence of substantial concentration of polyaromatic hydrocarbons (PAH). Samples collected at Crescent Beach ('clean') and 18 Mile Creek ('relatively clean') had similar chromatographic profiles, although concentrations of certain PAHs differed. The profile from Smokes Creek ('polluted') had more PAH, and generally at higher concentrations, with the exception of 731.84 nanogram/g wet wt fluoranthene at Crescent Beach. Sediment from Smokes Creek had a chromatographic PAH profile similar to that observed for fish stomach contents from that site, with each individual peak resolved, in the sediment but at higher concentrations. Compounds identified in this study were fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzanthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene, and indeno(1,2,3-c,d)pyrene. Analysis of stomach contents of bottom-feeding fish might be used to determine PAH levels in areas where sediment samples are difficult to obtain. (Rochester-IVI)
W86-00694

PCBS IN STRIPED BASS COLLECTED FROM THE HUDSON RIVER, NEW YORK, DURING FALL, 1981,
State Univ. of New York at Albany. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 5C.
W86-00695

TOXICITY AND ACCUMULATION OF COPPER AND CADMIUM IN THE ALGA SCENEDESMUS OBLIQUUS LH,
Vysoka Skola Zemedelska v Praze, Ceske Budejovice (Czechoslovakia). Faculty of Agricultural Economics and Management.
For primary bibliographic entry see Field 5C.
W86-00697

SIMULATED SOLUTE MOVEMENT IN WASTEWATER-PONDED SOIL,
Florida Univ., Gainesville. Dept. of Plant Pathology.
For primary bibliographic entry see Field 5D.
W86-00699

SOLUTE DISPERSION DURING AXISYMMETRIC THREE-DIMENSIONAL UNSATURATED WATER FLOW,
Department of Scientific and Industrial Research, Palmerston North (New Zealand). Div. of Plant Physiology.
For primary bibliographic entry see Field 2G.
W86-00700

SOLUTE DISCHARGE DURING STEADY WATER DRAINAGE FROM A SAND TANK,
Florida Univ., Gainesville. Dept. of Plant Pathology.
For primary bibliographic entry see Field 2G.
W86-00701

MONTE-CARLO SIMULATION OF NONINTERACTING SOLUTE TRANSPORT IN A SPATIALLY HETEROGENEOUS SOIL,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 2G.
W86-00702

MOBILITY OF ZINC, CADMIUM, COPPER, LEAD, IRON AND ARSENIC IN GROUND WATER AS A FUNCTION OF REDOX POTENTIAL AND PH,
Essen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 9 - Geologie.
R. Hermann, and P. Neumann-Mahlkau.
Science of the Total Environment, Vol. 43, No. 1-2, p 1-12, May, 1985. 11 Fig, 23 Ref.

Descriptors: *Groundwater pollution, *Zinc, *Cadmium, *Copper, *Lead, *Iron, *Arsenic, *Redox potential, *Hydrogen ion concentration, Path of pollutants, Solubility, Soil contamination, Heisinger Aue, Germany (Federal Republic).

In most industrialized regions, surface water and soil are contaminated with Cd, As, Pb, and Zn as a result of air and water pollution over many years. When the groundwater table moves up into the zone of contaminated soil, the redox potential and ph, as well as the mobility of the toxic elements are changed and can pose a threat if the contaminated area is a source of drinking water. The analysis of ground water taken from different soil horizons in the Heisinger Aue area (Essen, Federal Republic of Germany) confirmed the theoretically calculated influence of the redox potential and pH on the mobility of these elements. Zn, Cd, and Cu only show a pronounced solubility in an oxidizing environment. The degree of solubility in such environments depends largely on the pH. In a reducing environment, the solubility of Zn, Cd, and Cu can be decreased because of sulfide formation. Within the ranges of Eh and pH observed the mobility of Pb seems to be relatively low. Arsenic, like Fe, was found to be much more mobile under reducing than under oxidizing conditions. Groundwater of low Eh may be contaminated by As contained in polluted soils, sediments, or wastes. (Moore-IVI)
W86-00706

MERCURY DISTRIBUTION IN A POLLUTED MARINE AREA. CONCENTRATIONS OF METHYL MERCURY IN SEDIMENTS AND SOME MARINE ORGANISMS,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5A.
W86-00707

CHEMICAL COMPOSITION OF HIGHWAY DRAINAGE WATERS; I. MAJOR IONS AND SELECTED TRACE METALS,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
R. M. Harrison, and S. J. Wilson.
Science of the Total Environment, Vol. 43, No. 1-2, p 63-77, May, 1985. 2 Fig, 3 Tab, 27 Ref.

Descriptors: *Drainage water, *Chemical composition, *Trace metals, *Highways, Dissolved solids, Particulate matter, Potassium, Magnesium, Sodium, Calcium, Chloride, Sulfates, Lead, Iron, Manganese, Copper, Cadmium, Storm runoff.

Measurements of volumetric discharge and concentrations of dissolved (< 0.45 micro-m) and particulate (> 0.45 micro-m) major ion and trace metal components or road drainage water have been made during ten storm events at a motorway site in northwest England. With the exception of K(+) and Mg(2+), which were often significantly associated with the particulate (> 0.45 micro-m) fraction, the major ion constituents (Na(+), Ca(2+), Cl(-) and SO4(2-) were predominantly in the dissolved (< 0.45 micro-m) fraction. Of the trace metals, Pb and Fe were largely particle-associated, Mn was predominantly dissolved, and Cu and Cd exhibited intermediate behavior. A 'first flush' effect is seen for the dissolved (< 0.45 micro-m) components, but the particle-associated elements show a much more complex temporal variation related to storm intensity and the flushing of large-grained sediment through the drainage system. (Author's abstract)
W86-00708

CHEMICAL COMPOSITION OF HIGHWAY DRAINAGE WATERS; II. CHEMICAL ASSOCIATIONS OF METALS IN THE SUSPENDED SEDIMENT,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
R. M. Harrison, and S. J. Wilson.
Science of the Total Environment, Vol. 43, No. 1-2, p 79-87, May, 1985. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Highways, *Drainage waters, *Metals, *Suspended sediments, Lead, copper, Iron, Manganese, Runoff, Particle size.

Chemical associations of metals in the suspended sediment fraction of highway drainage waters have been investigated. Significant positive correlations between concentrations of pairs of metals in the suspended particles (> 0.45 micro-m) were found, the most highly correlated being Pb and Cu, Fe and Cu, and Fe and Mn. The concentrations of metals in the suspended sediment decrease with increasing concentrations of suspended solids in the runoff water indicative of lower metal concentrations associated with larger grained sediments suspended at high discharge rates. Sequential extraction of suspended solids separated by centrifugation showed similar chemical associations of metals to those in road surface dusts, with a generally higher overall metal concentration in the suspended solids. This is interpreted as indicating that the suspended sediment is derived from road surface dusts modified by preferential suspension of the finer grain sizes. (Author's abstract)
W86-00709

CHEMICAL COMPOSITION OF HIGHWAY DRAINAGE WATERS; III. RUNOFF WATER METAL SPECIATION CHARACTERISTICS,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
R. M. Harrison, and S. J. Wilson.
Science of the Total Environment, Vol. 43, No. 1-2, p 89-102, May, 1985. 1 Fig, 7 Tab, 12 Ref.

Descriptors: *Highways, *Drainage waters, *Runoff, *Metals, *Chemical speciation, Cadmium, Copper, Lead, Manganese, Iron, Storm runoff, Hydrogen ion concentration, Flow.

As part of an investigation of the removal of road surface contaminants in runoff water, samples of road drainage water have been examined by a comprehensive speciation scheme involving size discrimination by filtration through Nuclepore filters, anodic stripping voltammetry both with and without UV irradiation, and equilibration with Chelax resin, with a view to understanding the chemical associations of Cd, Cu, Pb, Mn and Fe in the waters. Samples were taken to represent different stages of a storm event and changes in speciation are seen to reflect changes in the flow regime and pH of the drainage water system. Upon leaving the highway, the waters enter a small receiving stream in which the speciation characteristics of the water downstream of the outfall were found to be dominated by the input drainage waters. (Author's abstract)
W86-00710

EULERIAN MODEL FOR SCAVENGING OF POLLUTANTS BY RAINDROPS,
General Motors Research Labs., Warren, MI. Environmental Science Dept.
S. Kumar.
Atmospheric Environment, Vol. 19, No. 5, p 769-778, 1985. 6 Fig, 4 Tab, 24 Ref.

Descriptors: *Rain, *Scavenging, *Air pollution, *Eulerian models, Water pollution sources, Simulation, Adsorption, Differential equations, Hydrogen ion concentration, Ammonia, Hydrogen peroxide, Sulfur dioxide, Formaldehyde, Nitric acid, Solubility.

An Eulerian model for simulating the coupled processes of gas-phase depletion and aqueous-phase accumulation of the pollutant species during a rain event has been formulated. The model is capable of taking into account any realistic vertical profile of pollutant species concentrations and time-dependent initial aqueous-phase concentrations at the cloud base. The model considers the processes of single species absorption and tion in the aqueous phase. The couple differential equations constituting the m discretized into a set of ordinary differen tions by using the Galerkin method with functions as the basis functions. These are solved to obtain the pollutant concent the gas phase and raindrops as well as t raindrops as a function of time and distan cloud-base. Simulations are performed for ing of gaseous HNO3, H2O2, SO2, form and NH3. For the case of highly solub and H2O2, raindrops are far from equilibr gas phase and their capacity for absorptio gases is undiminished even as they reac level. The gas-phase concentrations for t cies decrease exponentially with time washout is determined primarily by the r sity and mass-transfer coefficient of the species to the raindrops. The pollutant spe centrations in raindrops are an almost lin tion of the distance below the cloud base simulation conditions considered in this s half-life periods of these gases for remo the atmosphere range from 15 to 40 min. and formaldehyde, the aqueous-phase c tions approach equilibrium as the drop ground level and the gas-phase conc show large gradients in the vertical. Half ods for SO2 range from 1.3 to 13 h depe the initial raindrop pH and rain inten formaldehyde, the half-life ranges from min. Solubility of NH3 is a strong functi raindrop pH. As NH3 is absorbed, the rai increases and NH3 solubility decreases. acidified drops (pH = 4.6), ammonia so very high and the drops are far from eq with the gas phase throughout the fallin The half-life for ammonia ranges from over 3 h in these simulations. (Author's
W86-00718

WET AND DRY DEPOSITION MONI IN SOUTHEASTERN MICHIGAN,
General Motors Research Labs., Warren vironmental Science Dept.
For primary bibliographic entry see Field
W86-00719

NUTRIENT FLUXES IN EUTROPHIC AL LOUISIANA FRESHWATER LAKE
Louisiana State Univ., Baton Rouge. C Wetland Resources.
For primary bibliographic entry see Field
W86-00724

HEAVY METAL CONCENTRATIONS NICIPAL WASTEWATER TRE PLANT SLUDGE,
O'Brien and Gere Engineers, Inc., Syra
S. J. Spiegel, J. K. Farmer, and S. R. Gar
Bulletin of Environmental and Toxicol 35, No. 1, p 38-43, July, 1985. 3 Tab

Descriptors: *Municipal wastewater, *W treatment, *Sludge, *Heavy metals, *N Fate of pollutants, Metals, Primary w treatment, Secondary wastewater treatm trial wastes, Industrial wastewater, Wate sources.

Analysis of metals in final sludges from pal wastewater treatment plants in New revealed wide variations among plants f metal. Final sludges from Schenectady Dunkirk, Poughkeepsie, Herkimer Coun town, Peekskill, and Yonkers had receiv ary treatment; sludge samples from Ma Port Chester, and Blind Brook had rec primary treatment. Concentrations of pr lutant metals at the plants in which treatment was employed varied widely (kg), for example: Ag, 0.62-54; As, 0.0 0.15-14.6; Cr (total), 1.6-3,628; Hg, 0.07 Pb, 6.1-472. Wide variations were als values for sludges receiving only prim ment. Within the two groups, Yonkers Chester, respectively, had generally m levels of most heavy metals than the ot

variability in analyses among the remaining was so great no categorization based on metals was possible. The differences among in terms of heavy metal content seem to be differences in local industrial contributions wastewater and differences in domestic con- ns of specific heavy metals. (Rochester-

0726

RS INFLUENCING THE HIGH CON- OF BROMINATED TRIHALOMETH- IN BARCELONA'S WATER SUPPLY

d General de Aguas de Barcelona (Spain).
ura, and J. Rivera.
of Environmental Contamination and ogy, Vol. 35, No. 1, p 73-81, July, 1985. 3 ab, 12 Ref.

tors: *Brominated trihalomethanes, *Bar- *Spain, *Water supply, *Llobregat River, uality, Chlorine, Water treatment, Fate of ts, Water pollution sources.

from salt mines upstream, chlorine added treatment, and total organic carbon all play roles in trihalomethane (THM) for- n the water supply of Barcelona, Spain. mples from the Llobregat River, a stream polluted from textile, galvanic, coal, salt nd pulp mill industries, and farms and s, were subjected to a series of tests to e the source of the THMs. Maximum rmation occurred about 20 hr after addi- 12 to the raw water, which is in agreement lts with finished water. As Cl2 concentra- increased from 5-50 mg/l, there was a ards more chlorinated compounds at the f more brominated ones. A change of as mg/l Cl2 in these waters of high ammo- romide content increased the THM con- ore than 30% in some cases. It was also d that formation of chloroamines pro- e rapidly than synthesis of hypobromite, fore bromoamines are probably produced rates than BrTHMs which accounts for evels of BrTHMs measured. After 6 wk, ency of granular activated carbon for f THMs dropped to below 20%, with pounds, such as CHCl3, being retained at 20% efficiency within 3-4 wk. This ap- be due to the organic pollution load of r. THM levels in Barcelona's drinking ibit strong variations associated with the releases at the salt mines, other industrial ong the river, and the extreme changes ischarge. Inconsistent results were ob- an attempt to correlate THM content organic carbon. High levels of BrTHMs reduced by installation of a pipeline t mine wastes directly to the sea. (Roch-

7

VATER RUNOFF FROM INDUSTRI-

Woodman, Inc., Crystal Lake, IL.
le.
Engineering, Vol. 16, No. 12, p 34-37, 1984. 3 Fig.

s: *Storm runoff, *Runoff, *Water pol- ces, *Industrial plants, Industrial wastes, noff relationships, Urban runoff.

ated runoff is leaving an industrial site, ation should be instituted that consists of ng steps: (1) analysis of storm water ples to determine the types and quanti- utants present, (2) determination of the rates and runoff volumes for the site, nation of required reduction in pollut- ding on whether site is a point or non- e), (4) evaluation of different manage- iques, and (5) development of an effec- ment strategy. A typical equation for peak runoff rates is: $Q = C \times I \times A$, peak runoff rate in cu ft/sec of water, ensionless runoff coefficient based on characteristics of the site, I = rainfall intensity in inches/hr, and A = the size of the drainage area in acres. Values of runoff rates increase according to rainstorm frequency (100 yr > annual), and according to type of development (downtown business > industrial > residential). For example, the runoff expected from a residential area with a rainstorm that would be expected to occur every 2 yr (0.51 cu ft/sec/acre) is much less than the 2 yr-occurrence figure for a downtown business area (1.23 cu ft/sec/acre). Management techniques available for control of runoff from industrial sites include segregation of polluted runoff from nonpolluted runoff, spill containment, and, if necessary, treatment to remove pollutants before discharge. (Rochester-IVI)
W86-00766

TRACE-METAL CONCENTRATIONS IN SEDIMENTS FROM TWO CLOSED-BASIN LAKES, ANTARCTICA,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2H.
W86-00770

MATHEMATICAL MODEL FOR ANALYSIS OF SEDIMENT CORE DATA: IMPLICATIONS FOR ENRICHMENT FACTOR CALCULATIONS AND TRACE-METAL TRANSPORT MECHANISMS,
Freshwater Biological Association, Ambleside (England).
J. Hilton, W. Davison, and U. Ochsenbein.
Chemical Geology, Vol. 48, No. 1/4, p 281-291, March, 1985. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Mathematical models, *Trace metals, *Enrichment factors, *Sediments, Fate of pollutants, Aluminum, Potassium, Magnesium, Zinc, Cadmium, Iron, Nickel, Copper, Lead, Clay, Minerals, Lake sediments.

The concentration of trace metal within a sediment core has been modelled by considering three components, the background concentration, C sub b, that due to accelerated erosion, C sub a, and an anthropogenic pollution term, C sub p. Major cations associated with clay minerals such as Al, K and Mg do not have a pollution component. Iterative regression of the trace-metal concentration against one of these elements permits the isolation of C sub p. The model was applied to a comprehensive data set for a sediment core collected from a seasonally anoxic lake. Three groups of trace metals were identified. Type A (Zn and Cd) did not have a component due to accelerated erosion, C sub a. They are thought to have passed through a solution phase before being recruited to the sediment. Type-B metals (Fe, Ni, Cu and Pb) correlated well with the clay mineral elements and were probably transported to the sediment as particles. Mn, the type-C metal, was inversely related to the clay mineral cations, reflecting its labile redox chemistry. Various methods of calculating metal enrichment were compared with the new enrichment after regression analysis procedure (ERA method). Although simple concentration ratios are appropriate for type-A metals neither this procedure nor enrichment factors can adequately assess enrichment of type-B metals. (Author's abstract)
W86-00772

INFLUENCE OF PH ON THE BINDING CAPACITY AND CONDITIONAL STABILITY CONSTANTS OF ALUMINUM AND NATURALLY-OCCURRING ORGANIC MATTER,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 2K.
W86-00773

STATUS OF NONPOINT SOURCE POLLUTION: ITS NATURE, EXTENT AND CONTROL,
Battelle Columbus Div., OH.
B. W. Vigon.
Water Resources Bulletin, Vol. 21, No. 2, p 179-184, April, 1985. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Nonpoint pollution sources, *Water pollution control, Water pollution sources, Water quality, Stream pollution.

Nonpoint source pollution remains as the primary reason for the designation of many of the Nation's streams as 'water quality limited.' This means that even with the application of technology-based effluent limitations on point sources, ambient water quality standards will not be met. This paper explores several of the reasons why nonpoint sources are so difficult to come to grips with. These reasons include: (1) the inability to expand the definition of nonpoint sources to encompass nonengineering attributes, (2) the relatively primitive state of characterizing nonpoint sources, (3) the lack of prior success in conducting programs to study and alleviate nonpoint problems, and (4) and uncertain approach to providing incentives for control practices. (Author's abstract)
W86-00779

POLLUTANT RUNOFF MODELS: SELECTION AND USE IN DECISION MAKING,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
K. H. Reckhow, J. B. Butcher, and C. M. Marin.
Water Resources Bulletin, Vol. 21, No. 2, p 185-195, April, 1985. 1 Fig, 47 Ref.

Descriptors: *Runoff, *Model studies, *Path of pollutants, *Decision making, Water quality managment, Planning, Costs, Simulation, Phosphorus, Eutrophication.

Models for pollutant runoff can be useful in water quality management planning if appropriately structured for the problem at hand. Accordingly, a 'top-down' approach is proposed for the examination of extant pollutant runoff models. The approach consists of the identification of objectives and attributes that reflect the needs of planners and decision makers when these models are used for water quality management planning. Ideally, the attributes should concern the effect of model information on improved decision making and the cost of model application. Practical difficulties with the first attribute necessitates substitution of surrogate attributes reflecting model appropriateness, resolution, and uncertainty. Common pollutant runoff models, in particular export coefficients and hydrology-driven simulation models, are found to have serious weaknesses on some of the attributes scales. The 'top-down' approach leads to a set of desirable pollutant runoff model attributes; alternate modeling techniques are thus examined in order to identify promising future directions for model development. The focus of this examination is phosphorus, due to its importance in the eutrophication of surface waters. Models for both sediment-attached and dissolved phosphorus are considered. Among the conclusions is the belief that the partial contributing area concept can yield an effective yet simple simulation despite the variable and complex nature of runoff. (Author's abstract)
W86-00780

URBAN RUNOFF: POLLUTION SOURCES, CONTROL, AND TREATMENT,
Environmental Protection Agency, Edison, NJ. Storm and Combined Sewer Technology Branch.
For primary bibliographic entry see Field 5G.
W86-00781

CHEMICAL COMPONENTS IN THE PRECIPITATION AT KOMORO AND TSUKUBA, JAPAN IN 1983,
Meteorological Research Inst., Tokyo (Japan).
Y. Dokiya, Y. Katsuragi, and S. Kobayashi.
Journal of Environmental Science and Health, Vol. A20, No. 3, p 269-291, April, 1985. 7 Fig, 5 Tab, 8 Ref.

Descriptors: *Chemistry of precipitation, *Precipitation, *Honshu Island, *Acid rain, *Japan, Hydrogen ion concentration, Chlorides, Nitrates, Sulfates, Sodium, Potassium, Calcium, Magnesium, Water pollution sources, Air pollution, Spatial distribution.

The net deposition of major chemical components by precipitation in the Honshu Island of Japan was

investigated during each precipitation event for one year in 1983 at two sites: Komoro City, an inland city and Tsukuba Science City, which was located on the Pacific side. Both sampling sites are at a similar latitude and are rural areas of similar population. The concentrations of hydrogen ion, chloride, nitrate, sulfate, sodium, potassium, calcium and magnesium ions were determined in samples from each rain and summarized on a monthly basis. The concentrations of hydrogen, sulfate and nitrate ions were several times higher at Tsukuba than at Komoro. The average pH at Tsukuba and Komoro were 4.54 and 5.34, respectively; the former was apparently influenced by the polluted air from the industrial area including Tokyo and the latter was comparatively free from the influence. The identification of sources for each chemical component is discussed. (Author's abstract)
W86-00810

DISTRIBUTION AND PERSISTENCE OF AMINOCARB IN STREAM WATER, SEDIMENT AND FISH AFTER APPLICATION OF THREE MATACIL FORMULATIONS,
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
K. M. S. Sundaram, and S. Szeto.
Journal of Environmental Science and Health, Vol. B20, No. 2, p 187-200, April, 1985. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Aminocarb, *Insecticides, *Fate of pollutants, *Path of pollutants, *Streams, *Fish, *Sediment, Water pollution effects, Trout, Pesticides.

Three aminocarb formulations, water-based Matacil 180F, oil-based Matacil 180F and oil-based Matacil 180D, were applied separately to the surface of a stream at 2.40 g a.i./min for 5 minutes. The highest aminocarb concentration in the top 1 cm of water (5000 ppb) was found 5 min after application of oil-based 180F. The next highest concentration was 1862 ppb found in the top 1 cm layer of water 3 min after application of oil-based 180D, followed by 1306 ppb found 5 min after application of water-based 180F. Residue accumulations were first observed in sediment at 3 min and in fish tissues 0.5 h after application. The levels of accumulation were in the order of water-based 180F > oil-based 180F > oil-based 180-D. After the application of water-based 180F, the highest concentrations were 20.2 ppb in sediment after 5 min and 127 ppb in fish tissues after 3 h. Residues disappeared rapidly from all three matrices and could not be detected after a period of 3-25 h. (Author's abstract)
W86-00811

SORPTIVE CAPACITY OF AN AQUATIC MACROPHYTE FOR THE PESTICIDE AMINOCARB,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W86-00812

DISTRIBUTION OF GAMMA EXPOSURE RATES IN A REACTOR EFFLUENT STREAM FLOOD PLAIN SYSTEM,
Savannah River Ecology Lab., Aiken, SC.
J. B. Gladden, K. L. Brown, M. H. Smith, and A. Towns.
Health Physics, Vol. 48, No. 1, p 49-59, January, 1985. 3 Fig, 3 Tab, 26 Ref. U.S. DOE contract DE-AC09-76SR00819.

Descriptors: *Gamma radiation, *Cesium radioisotopes, *Fate of pollutants, Path of pollutants, Radiation, Radioisotopes, Sediments.

Ground-level gamma dosimetry surveys were conducted along the length of a radiocesium-contaminated reactor effluent stream flood plain system to determine the extent and patterns of isotope distribution over a decade after reactor releases were stopped. The maximum mean exposure rates were found at upstream locations near the source of the contamination and in a downstream sedimentary delta. Gamma exposure rates were not uniformly distributed and high exposure rates were generally restricted to small areas of the flood plain. There was little similarity in either the spatial distribution or magnitudes of maximum gamma exposure rates across flood plains along the stream. Frequency distributions of the measured exposure rates tended to be highly skewed and most closely approximated the log-normal distribution in most areas along the stream. However, the complex and changing patterns of dose distributions strongly affected the ability to predict the probability of encountering unusually high exposure rates. Complex statistical and distributional models are required to provide precise descriptions of the dosimetry environment in such complex ecosystems and different models could be required on a site-by-site basis. (Author's abstract)
W86-00821

RADIOCESIUM LEVELS IN IRISH SEA FISH AND THE RESULTING DOSE TO THE POPULATION OF THE IRISH REPUBLIC,
Trinity Coll., Dublin (Ireland). Dept. of Pure and Applied Physics.
I. R. McAulay, and C. Doyle.
Health Physics, Vol. 48, No. 3, p 333-337, March, 1985. 2 Fig, 1 Tab, 4 Ref. Commission of European Communities contract B10/B/388/80/EIR(H).

Descriptors: *Cesium radioisotopes, *Irish Sea, *Fish, *Public health, *Radiation, *Sellafield, Path of pollutants, Whiting, Cod, Plaice, Prawn, Herring.

Radioactive wastes in have been released from the nuclear fuel reprocessing plant at Sellafield (formerly 'Windscale') for longer than two decades under license from British authorities. Most monitoring has been conducted in the Eastern Irish Sea close to the discharge point with the result that less is known about radiocesium levels off the Irish coast. Whiting, cod, plaice, prawn, and herring samples were obtained from the commercial fishing grounds off the East Irish Coast and assayed for Cs-137 and Cs-134 contamination; average activities of 68 and 3 Bq/kg (wet, fillets) of Cs-137 and Cs-134, respectively, were determined. The ratio of Cs-137 to Cs-134 present in the samples was about 23; during the same period, the ratio in fish caught near Sellafield was about 15. The difference in the ratios is explained by the time taken for transport of the radiocesium from the East Irish Sea to the West Irish Sea and the average residence time in the West Irish Sea; this time lag can be estimated from these ratios to be about 1.4 yr. The radiation dose incurred by a person eating fish will depend on the average activity of the fish and the quantity eaten. The average activity of different species will in general be different. The assumed dose rate due to penetrating environmental radiation for the collective population is 3400 man-Sv/y. The estimated population dose to the Irish public due to fish consumption is approximately 2 man-Sv/y - only 0.06% of the environmental dose. Critical groups may exist, such as fishing communities along the east coast, for whom doses may be higher. The possible dose to a member of the critical group is 1.4% of the limit recommended by the International Commission on Radiological Protection. (Collier-IVI)
W86-00822

RADIOLOGICAL IMPACT OF MINING IN A TH-RICH NORWEGIAN AREA,
Statens Inst. for Straalehygiene, Oslo (Norway).
E. Stranden.
Health Physics, Vol. 48, No. 4, p 415-420, April, 1985. 6 Tab, 12 Ref.

Descriptors: *Radioisotopes, *Mining, *Thorium, *Norway, Drinking water, Water pollution sources, Public health, Radon, Radium, Niobium, Radiation.

The radiological impact of former mining activities in the Fen area in southern Norway has been assessed. The area is known to have enhanced concentrations of Th. A recent epidemiological study suggested a significant increment of lung cancer among the former miners, and the doses to the miners have been assessed. The main contributor to the effective dose equivalent in one of the mines was inhaled Rn-220 progeny. W drilled wells and in nearby lakes was anal Rn-220 and Ra Uranium and Th analy performed on mine and lake water. Th activity does not seem to have contamina ing water significantly. The tailings from duction has enriched Ra and Th conce The tailings and the possible use of wa from the mining are probably the most i environmental results of the mining activi thor's abstract)
W86-00823

MICROBIOLOGICAL QUALITY OF ATIONAL WATERS IN THE PACIFIC WEST,
Environmental Protection Agency, Seat Region X.
G. J. Vasconcelos, and N. C. Anthony.
Journal of Water Pollution Control Fe Vol. 57, No. 5, p 366-377, May, 1985. 1 F 34 Ref.

Descriptors: *Water quality, *Recreation *Bacteria, Washington, Oregon, Idaho, M vironment, Water pollution sources, C Bioindicators.

A 5-yr study of total coliforms (TC), f forms (FC), Escherichia coli, fecal str (FS), enterococci, and water quality ind eight freshwater and two marine beach Pacific Northwest (USA) revealed large in bacterial count and water quality. samples, one for bacteria and one for wa sis, were obtained at each of the sites, w in or near the cities of Seattle, Spokane, ston, Washington, Eugene, Oregon, and Idaho. Most locations were city, county parks with records of heavy bather use f a 4-mo summer season, and more than sites were located downstream or wastewater treatment plant outfalls. Be the highest TC and 20 C plate count nism levels were both surrounded by lar tial communities subject to urban ru marine beaches at Alki and Gold Gar relatively low in TC and PC microorg most instances FS densities determined procedure were higher than enterococci by the mE procedure. Beaches with values of enterococci did not always h spondingly high mean FC values and, beaches with high FC averages did have a high enterococci average. Wa criteria for Northwest recreational wat include guidelines based on both micro ties and an assessment of human health r ated with the potential for disease tr Marine recreational waters may share degree of microbiological pollution as but the potential for contact illness an mers is less because of lower seasonal perature. With the exception of wate tures, all physical and chemical me made during this study were similar, re location or season. The lack of variabil measurements precludes their use in fu toring studies. (Rochester-IVI)
W86-00840

BACTERIAL ADSORPTION AND SU PARTICLES IN URBAN STORMWA
California State Univ., Northridge.
J. E. Schillinger, and J. J. Gannon.
Journal of the Water Pollution Control Vol. 57, No. 5, p 384-389, May. 1985. 4 28 Ref.

Descriptors: *Bacterial, *Adsorption, particulates, *Urban runoff, Storm Coliforms, Klebsiella, Pseudomonas,

Fecal coliforms collected from a storm showed significantly lower mean r screens (15.9%) and less sedimentati than did the opportunistic pathoge (25.7% and 33.0%, respectively) o group measured as Gram-negative bac and 46.7%, respectively). In every ca

than 50% of the stormwater bacteria were
ttled or filtered (< 5 micrometer), which
d that sufficient numbers of bacteria may
suspended in water under similar treatment
ions to pose a health hazard. These storm-
results suggest that adsorption (retention and
g) was of sufficient magnitude (average 16-
o warrant study of bacterial attachment and
ntation when modeling bacterial disappear-
natural waters or treatment processes. Sam-
ed in this study were all collected at the
f peak flow during storm events at Allen
near Ann Arbor, Michigan. Most bacteria
re retained on screens were associated with
s retained on 52 micrometer or 30 microm-
reens. Nutrient agar-grown pure cultures
uch less effectively adsorbed on added sedi-
an were broth-grown cells. The presence
riae (pili) on broth-grown Escherichia coli,
n by electron microscopy, and polysaccha-
ne layers produced by Klebsiella and Pseu-
s may have affected bacterial attachment,
irst case positively, and in the second case
ely. (Rochester-IVI)
842

RS AFFECTING STREAM TRANSPORT
MBINED SEWER OVERFLOW SEDI-
,
Young Univ., Provo, UT.
emetson.
of the Water Pollution Control Federation,
No. 5, p 390-397, May, 1985. 5 Fig, 15
Ref.

ors: *Combined sewer overflows, *Sedi-
ransport, *Sedimentation, Wastewater,
unoff, Particle size, Specific gravity, Vis-
ensity.

ter and urban runoff were characterized
lly, and these characteristics were extrap-
obtain combined sewer overflow (CSO)
istics of importance to the physical trans-
CSO solids. The contribution of
er to the total flow may be negligible in
es, although its effect on time-dependent
in the CSOs may be important. Urban
unoff makes up the majority of CSO in
es. The characteristics of urban-surface
y, as a first approximation, be considered
those of street-surface solids. In model-
ransport of CSO solids, two basic classes
esses must be considered: (1) transport
n the quiescent settling characteristics of
and (2) any time-dependent changes in
ng characteristics, mass rate, or other
variables must be included in the analy-
variables that affect quiescent settling of
non-reactive particles are particle size,
ravity and shape, and fluid density and
These data are available from a variety
, and from them it is possible to generate
may be at least representative of selected
s characteristics. (Rochester-IVI)
3

CATION OF A METAL ADSORPTION
TO DESCRIBE THE EFFECT OF PH,
nd M Univ., College Station. Dept. of
neering.
n, B. Batchelor, and S. C. Chapra.
the Water Pollution Control Federation,
No. 5, p 425-427, May, 1985. 2 Fig, 10

s: *Metals, *Adsorption, *Hydrogen ion
ion, *Mathematical models, Fate of pol-
odel studies, Sediments, Solution equilib-

n metal adsorption model was modified
the effect of pH on adsorption apart
value of the equilibrium constant. This
llows easy estimates of pH effects for a
nge using concentration techniques for
ultaneous chemical equilibriums. The
n of the model also allows it to be more
polated to describe adsorption in sys-
ifferent solution chemistry. The Nelson
predict speciation at arbitrary pH values
only by interpretation or extrapolation from the pH values used to calculate the conditional adsorption constant (K sub A). The modified model interprets adsorption as a competition between metal ions and protons for surface sites. This surface complex modeling approach gave reasonably good fit between measured and predicted metal adsorption onto Meuse River sediments. Alternatively, the Langmuir isotherm used in the modified model can be expressed in mass concentration units to allow calibration against experimentally determined adsorption data. This alternative formulation includes pH effects. The present modification of Nelson's model can be incorporated into equations for determining the distribution of metals among species and surfaces. This approach has been used to predict diel variations of zinc in a reservoir where predicted mixing and ligand distributions were used to analyze variability in zinc distributions. The modification also provides for the use of computer equilibrium programs to describe adsorption equilibrium while describing solution equilibrium. (Rochester-IVI)
W86-00847

VIRAL POLLUTION OF THE MARINE ENVIRONMENT,
Minnesota Univ., St. Paul. Coll. of Veterinary Medicine.
S. M. Goyal.
CRC Critical Reviews in Environmental Control, Vol. 14, No. 1, p 1-32. 8 Fig, 13 Tab, 148 Ref. NOAA grant NA80AA-D00049.

Descriptors: *Public health, *Sludge disposal, *Ocean dumping, *Viruses, *New York Bight, Sewage outfalls, Fate of pollutants, Water pollution effects, Shellfish, Path of pollutants, Water quality standards.

Available data on the occurrence, transport, and fate of enteric viruses in the marine environment are summarized, and the viral hazards to human health associated with the disposal of sewage effluents and sludges in coastal and open ocean waters are assessed. Human enteric viruses in domestic sewage, fate and transport of viruses in the marine environment, including occurrence and survival in coastal waters, association with solids, and accumulation in shellfish, and methods for detection of viruses in water, sediment, and shellfish are described. Viruses in coastal waters have been associated with canal communities, which are very popular along the coasts of Florida, Mississippi, California, Louisiana, and Texas, with submarine offshore sewage outfalls, with disposal of dredged material from harbors, channels, and other navigable waterways, and as the direct result of sludge dumping. Viruses have been found in sediments both inside and outside the shellfish closure area in the New York Bight and at the Philadelphia disposal site, including some isolations made at the latter site 17 mo after cessation of sludge dumping. All current standards for viruses in recreational and potable water are arbitrary and reflect limitations of detection methodology for enteric viruses in water rather than disease risk. Present epidemiological methods are not adequate to gain a complete understanding of the true extent of transmission of viral disease by marine waters. (Rochester-IVI)
W86-00851

HYDROUS FE AND MN OXIDES - SCAVENGERS OF HEAVY METALS IN THE AQUATIC ENVIRONMENT,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
S. K. Singh, and V. Subramanian.
CRC Critical Reviews in Environmental Control, Vol. 14, No. 1, p 33-90. 21 Fig, 33 Tab, 221 Ref.

Descriptors: *Iron oxides, *Magnesium oxides, *Heavy metals, *Coatings, *Detritus, Metals, Hydroxides, Fate of pollutants, Water pollution control, Adsorption.

The role of Fe(OH)3 and MnO2 coatings on detrital particles in the control of heavy metals in rivers and estuaries is discussed. Heavy metals in the environment, chemistry of hydrous metal oxides, heavy metals in river water, water-sediment interactions, hydroxide coatings and concretions, effects of particle size on sediment composition, and fixation of heavy metals by hydrous Fe/Mn oxides are reviewed. Mechanisms of trace metal fixation by hydrous Fe/Mn oxides are discussed, including the roles of precipitate age and organic material in uptake of heavy metals by hydrous Fe/Mn oxides. Remobilization of heavy metals, application of hydrous oxides to pollution control, heavy metals in sewage sludges, and the role of Fe/Mn oxide-mediated absorption of heavy metals in natural systems are also reviewed. Several aspects of the role of hydrous Fe/Mn oxides in regulation of heavy metals in the environment remain unknown or poorly known. These include some of the scavenging mechanisms, selectivity of the hydroxides for given elements, and the quantitative importance of coatings in relation to other sinks, notably organic coatings. The interelemental relationships among hydroxides and heavy metals suggest that hydroxides may be useful in wastewater treatment and pollution control, and the economic recovery of useful metals from hydroxide coatings may be possible. (Rochester-IVI)
W86-00852

ASBESTOS IN DRINKING WATER
Department of National Health and Welfare, Ottawa (Ontario). Health Protection Branch.
P. Toft, M. E. Meek, D. T. Wigle, and J. C. Meranger.
CRC Critical Reviews in Environmental Control, Vol. 14, No. 2, p 151-197. 2 Fig, 11 Tab, 153 Ref.

Descriptors: *Asbestos, *Drinking water, *Public health, Transmission electron microscopy, Electron microscopy, Water pollution effects, Source of pollutants, Water treatment.

Methods of detection of asbestos in water, human exposure to asbestos in water, with emphasis on Canadian studies, and health effects of ingested asbestos are reviewed. Transmission electron microscopy with selected area electron diffraction is currently the best analytical method for determination of asbestos in drinking water. Concentrations of asbestos in drinking water range up to 2,000 million fibers/liter, but most samples analyzed have contained less than 10 million fibers/liter. 'Conventional' water treatment substantially reduces asbestos concentrations, although corrosive drinking waters may leach asbestos from asbestos-cement water mains. Epidemiological studies, all but one of which were ecological, have been insensitive and did not control for a number of potentially confounding variables. They did, however, provide some evidence for an association between ingested asbestos and cancer induction. No conclusive evidence for carcinogenicity or cocarcinogenicity of ingested asbestos has resulted from toxicological studies conducted with laboratory animals. Transmigration of asbestos fibers across the gastrointestinal wall cannot be ruled out, but there is little evidence for its widespread occurrence. The risk of developing disease from ingestion of asbestos at the concentrations found in most drinking water supplies is probably very small. Available information is insufficient to permit meaningful estimation of the magnitude of risk. (Rochester-IVI)
W86-00853

HEAVY METAL IN ISOPODS FROM THE SUPRA-LITTORAL ZONE ON THE SOUTHERN SHORE OF THE SEVERN ESTUARY, UK,
Bristol Univ. (England). Dept. of Botany.
S. P. Hopkin, M. H. Martin, and S. J. Moss.
Environmental Pollution (Series A), Vol. 9, No. 4, p 239-254, 1985. 1 Fig, 6 Tab, 48 Ref.

Descriptors: *Heavy metals, *Littoral zone, *Isopods, *Severn Estuary, *England, Zinc, Cadmium, Lead, Copper, Path of pollutants, Litter, Seaweed, Food, Smelters.

The concentrations of zinc, cadmium, lead and copper in the tissues of the littoral isopod Ligia oceanica from the three sites near to a primary zinc, lead and cadmium smelting works on the

southern shore of the Severn Estuary and an unpolluted site in the Menai Strait, Anglesey (England), were determined. The concentrations of zinc, cadmium and copper in whole L. oceanica from the contaminated sites were significantly higher than in specimens from the uncontaminated site, although the levels were only about one-and-a-half, three to four and twice as great, respectively. The amounts of lead in L. oceanica from all four sites were very small. The hepatopancreas was the most important storage organ of heavy metals and, at all sites, contained more than 50% of the total zinc, cadmium and copper in the body. The concentrations of heavy metals were compared in the tissues of L. oceanica and in two 'more terrestrial' isopods, Oniscus asellus and Porcellio scaber, collected from the same habitat at one of the contaminated sites. The mean concentrations of copper were the same in the hepatopancreas of all the isopods. However, there were large differences in the extent to which zinc, cadmium and lead had been accumulated by this organ in the three species. Analysis of the gut contents of the isopods revealed that all three species had been feeding on leaf litter derived from nearby trees, rather than on seaweed washed up onto the shore. Therefore, it was concluded that the extent to which zinc, cadmium and lead were assimilated by L. oceanica, O. asellus and Porcellio scaber must have been related to differences in their digestive physiology, rather than to choice of food material containing different concentrations of metals. (Author's abstract)
W86-00865

SORPTION OF MERCURY(II) BY HUMIC ACIDS,
Newcastle Univ. (Australia). Dept. of Chemistry.
P. Thanabalasingam, and W. F. Pickering.
Environmental Pollution (Series A), Vol. 9, No. 4, p 267-279, 1985. 3 Fig, 20 Ref.

Descriptors: *Mercury, *Fate of pollutants, *Humic acids, *Adsorption, Sediments, Hydrogen ion concentration, Calcium, Magnesium, Ammonium, Sulfates, Streams.

In a lake or closed estuary system, 90-99% of the total Hg present (predominantly inorganic species) may be associated in the sediments, with most of the residual fraction being associated with suspended particles. In experiments, uptake of Hg(II) (1-10 mg/l) by two humic acids varied with pH, with > 98% being sorbed at pH 4-5. Langmuir plots yielded adsorption capacity and bonding values of approximately 50 mmol/kg and 3,000,000 l/mol respectively. The addition of increasing amounts of chloride reduced uptake (10-20%) and shifted the maximum sorption region to higher pH values. The presence of 0.01 M levels of Ca(2+), Mg(2+) and NH4(+) promoted near total adsorption and reduced the pH effect; 0.001 levels slightly increased the amount of Hg(II) sorbed. Sulfate additions reduced Hg uptake. Much of the Hg(II) is considered to be chemisorbed, since while most of the sorbed species was extractable in 0.005 M EDTA, only half was released into 1 M HNO3 and molar salt solutions retrieved less than a third. The presence of humic acids in a sediment ensures that any added Hg(II) will become firmly bound to the solid phase, with levels in the adjacent aqueous phase being maintained at the < 50 micro-g/l level. With > 98% of any added Hg being retained, a high input rate into a natural system may result in rapid saturation of the surface of sediment beds. At the same time, with equilibrium favoring the solid phase it would seem that transport of Hg along streams will be associated mainly with suspended colloidal particles. (Moore-IVI)
W86-00866

PERSISTENCE OF ALDRIN IN FLOODED SOIL UNDER THE COVER OF RICE,
Haryana Agricultural Univ., Hissar (India). Dept. of Entomology.
G. Singh, T. S. Kathpal, K. S. Kushwaha, and G. S. Yadav.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, p 294-299, June, 1985. 2 Tab, 18 Ref.

Descriptors: *Flooded soil, *Rice, *Aldrin, Pesticide residues, Dieldrin, Fate of pollutants, Soil contamination, Flooding.

The persistence of aldrin in soil and its translocation into rice plants and grains were tested under two different field conditions. Treatment T1, which consisted of aldrin application at the rate of 1.5 kg active ingredient/ha at nursery sowing, did not leave aldrin residues in rice plants 40 days after application (10 days after transplanting). Dieldrin was present in plants to the extent of 0.04 ppm at this stage but completely disappeared (below detectable limit) within 70 days (30 days after transplanting). Treatment T2 involved aldrin application 10 days after transplanting in flooded soil at the same rate and left 0.518 ppm residues in soil just after application. These residues dissipated to their half in 90 days. At this stage its conversion to dieldrin was also observed. Remaining residues dwindled to below the detectable limit in 270 days. Plant samples analyzed from this treatment at 7 and 30 days contained 0.079 and 0.169 ppm aldrin and 0.025 and 0.08 ppm dieldrin, respectively. Rice grains also had aldrin and dieldrin residues (each at 0.001 ppm level) at harvest time but these were below the Maximum Tolerance Limits. Both the treatments were found safe from the toxic residue point of view. (Author's abstract)
W86-00875

EXAMPLE OF INTERACTION BETWEEN ENVIRONMENTAL POLLUTANTS: MODIFICATION OF THIRAM TOXICITY TO FRESHWATER ORGANISMS BY NITRITES OR NITRATES IN RELATION TO NITROSAMINE SYNTHESIS,
Rouen Univ., Mont-Saint-Aignan (France). Lab. de Toxicologie.
For primary bibliographic entry see Field 5C.
W86-00877

OCCURRENCE OF CHLORINATED POLYNUCLEAR AROMATIC HYDROCARBONS IN TAP WATER,
National Inst. for Environmental Studies, Tsukuba (Japan). Div. of Chemistry and Physics.
H. Shiraishi, N. H. Pilkington, A. Otsuki, and K. Fuwa.
Environmental Science and Technology, Vol. 19, No. 7, p 585-590, July, 1985. 4 Fig, 4 Tab, 19 Ref.

Descriptors: *Polynuclear aromatic hydrocarbons, *Chlorinated hydrocarbons, *Drinking water, Aromatic compounds, Hydrocarbons, Pollutant identification, Gas chromatography, Mass spectrometry, Chlorination, Raw water, Tsukuba, Japan.

The combination of a modified continuous liquid-liquid extraction and computerized gas chromatography/mass spectrometry using a fused silica capillary column enabled analysis of low concentrations of organic compounds in water. Tap water and raw water from Tsukuba, Japan were analyzed using this method. Monochlorinated derivatives of naphthalene, dibenzofuran, fluorene, fluorenone, phenanthrene, and fluoranthene and dichlorinated derivatives of naphthalene, phenanthrene, and fluoranthene were present in the tap water. The parent polynuclear aromatic hydrocarbons (PAHs) and their oxygenated derivatives such as fluorenone and anthraquinone were also found. Chlorinated PAHs were found in tap water at 0.1 to 0.01 ng/L levels, but were not found in the raw water. The presence of PAHs and chlorinated PAHs in tap water indicates the reaction of PAHs with residual chlorine. (Moore-IVI)
W86-00895

CARBONIZED COAL PRODUCTS AS A SOURCE OF AROMATIC HYDROCARBONS TO SEDIMENTS FROM A HIGHLY INDUSTRIALIZED ESTUARY,
Texas A and M Univ., College Station. Dept. of Oceanography.
E. G. Merrill, and T. L. Wade.
Environmental Science and Technology, Vol. 19, No. 7, p 597-603, July, 1985. 7 Fig, 2 Tab, 35 Ref.

Descriptors: *Carbonized coal products, *Hydrocarbons, *Polynuclear aromatic hydrocarbons, *Sediments, Water pollution sources, Estu
vironment, Creosote, Oil pollution, Tar, A
compounds, Carcinogens, Elizabeth River
ia.

Sediments near large urban areas may con
concentrations of anthropogenic hydrocar
to their proximity to source areas. Elizabe
(Virginia) sediments are contaminated w
levels of hydrocarbons (0.1-2.9 mg/g). H
bon distributions in carbonized coal produ
osote, coal tar, roofing tar, and creosote
were compared to that of ship stack an
stove soot, crude oil, fuel oil, and a fuel
Hydrocarbon distributions characteristic
bonized coal products were used to esti
level of creosote contamination in these s
Elizabeth River sediments are contamina
hydrocarbons from both carbonized coal
troleum products. Carbonized coal
appear to have point sources associated w
soting facility sites and are the main
carcinogenic polynuclear aromatic hydr
in the sediments. Petroleum products a
have many sources, are highly weathere
reaching the sediments, and are the main
the unresolved complex mixture. Carbon
products may contain compounds in ac
hydrocarbons (such as phenols) that may
their environmental impact. (Moore-IVI)
W86-00896

**FACTORS AFFECTING LEACHING
TRIENTS FROM AN INTENSIVEL
AGED GRASSLAND IN COUNTY
NORTHERN IRELAND,**
Department of Agriculture for Northern
Antrim. Freshwater Biological Investiga
C. Jorden, and R. V. Smith.
Journal of Environmental Management,
No. 1, p 1-15, January, 1985. 4 Fig, 4 Ta

Descriptors: *Leaching, *Nutrients, *G
*Northern Ireland, Nitrogen, Phosphor
age, Grazing, Particulate matter, Nitrate
nium, Manure, Pasture management.

Losses of nitrogen and phosphorus from
ly managed grassland were monitored d
ter and factor analysis of the weekly l
the various nitrogen and phosphorus frac
cated that the data could be divided into
groups of variables. The first group incl
soluble kjeldahl nitrogen and nitrate nit
second group included soluble reactive
rus, soluble organic phosphorus and
nitrogen. Particulate phosphorus and
kjeldahl nitrogen shared some charact
both groups, but tended to be more
group two above. The loadings of th
fractions in the first group were princip
mined by the flow through the drain -
in flow led to a proportionate incre
loadings of soluble kjeldahl and nitrat
Slurry (liquid manure) application a
during periods when the soil was close
tion led to much larger losses of solub
phosphorus, soluble organic phosphoru
um nitrogen, particulate kjeldahl nitrog
ticulate phosphorus, than losses of solut
nitrogen and nitrate nitrogen. Slurry a
silage cuts and grazing during dry per
negligible losses of nitrogen and p
Greatest losses of nitrate occurred a
rainfall following prolonged dry period
particularly evident in the autumn o
winter of 1983-84. (Author's abstract)
W86-00903

**FACTORS INFLUENCING HYDR
DEGRADATION IN THREE FRES
LAKES,**
Massachusetts Univ. at Boston. Environ
ence Program.
J. J. Cooney, S. A. Silver, and E. A. Be
Microbial Ecology, Vol. 11, No. 2,
1985. 1 Fig, 6 Tab, 14 Ref. OWRT g

Descriptors: *Microbial degradatio
*Fate of pollutants, *Hydrocarbons, W

Effects Of Pollution—Group 5C

laphthalene, Pristane, Tetradecadiene, Hexa-
, Kerosene, Lake sediments, Limiting nutri-
Dissolved oxygen, Oil pollution, Water tem-
re, Bacteria.

ixed microbial flora of 3 lakes on Ohio with
g histories of hydrocarbon pollution was
ed in relation to the ability to use hydrocar-
Weathered kerosene was spiked with naph-
, pristane, 1,13-tetradecadiene, and n-hexa-
and added to water-sediment mixtures from
kes, and utilization of the 4 marker hydro-
was measured. Each of the marker hydro-
was metabolized; naphthalene was the
adily used and pristane was the most resist-
alues for dissolved oxygen suggest that
did not limit hydrocarbon degradation in
er column at any site examined. Nutrient
studies indicated that nitrogen and phos-
imited hydrocarbon degradation at all sites
d. Maximum numbers of heterotrophic
were detected when the water tempera-
s 10 C or higher. The data indicate that
ture limits hydrocarbon degradation in the
except at a site which had beem impacted
l spill and which received chronic inputs
ocarbons and nutrients. In samples from
all 4 markers hydrocarbons were degrad-
C. Results of temperature and nutrient-
experiments suggest that different seasonal
ons of hydrocarbon users are selected at
but not at other lake sites. (Author's

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**TOXICITY TO CYANOBACTERIA
S DEPENDENCE ON EXTRACELLU-
GAND CONCENTRATION AND DEG-
ON,**
l Univ. (England). Dept. of Botany.
dim, and H. W. Pearson.
Ecology, Vol. 11, No. 2, p 139-148,
g, 26 Ref.

rs: *Plectonema, *Copper, *Toxicity,
Metals, Cyanophyta, Citrate, Nitrilotria-
d, Fate of pollutants, Biodegradation,
croorganisms.

vironment, the amelioration of the toxic
onic copper can be due to the complexa-
turally occurring ligands. Copper toxici-
cyanobacterium Plectonema boryanum
94) was investigated in the presence of
d nitrilotriacetic acid (NTA) using a
urated culture medium. The copper-cit-
ex was biodegradable, and toxicity was
on the free ligand concentration. The
rate to copper also affected the extent of
city. NTA was not degraded by P. bor-
gand degradation in the cyanobacterial
reased the ionic copper concentration
d a concomitant reduction in growth.
be taken when choosing complexing
to be used in metal toxicity tests in-
croorganisms, since if the compounds
ded, conditions will alter markedly
course of the experiment. The bioavaila-
rate (and thus presumably other organic
en when strongly complexed by metals,
ical implications. Consumption of the
eterotrophs may increase metal toxicity
g the ionic concentration, and this may
incide with a decrease in the soluble
ntrations. (Moore-IVI)

cts Of Pollution

**OF TREATED SEWAGE EFFLUENT
BOTTOM MUD ON GROWTH OF
HYTOPLANKTON,**
hi, N. Imada, and Y. Oshima.
letin of the Faculty of Agriculture,
iversity, Vol. 39, No. 4, p 143-151,
4 Fig, 4 Tab, 19 Ref.

*Eutrophication, *Wastewater pollu-
oplankton, *Estuarine environment,
iments, Nitrogen, Phosphorus, Water
ects, Coastal waters, Mud.

As nitrogen and phosphorus sources, the treated sewage effluent and the bay-bottom and mud promote the eutrophication of estuarial and coastal areas, especially closed bays. The present paper deals with the effects of the treated sewage effluent and the bay-mud exudate on the growth of various phytoplankton species present in natural sea water. 1. Five sampling stations were set in the area receiving the effluent from Fukuoka Eastern Sewage Disposal Plant. 2. Throughout six investigations from May to November in 1979, the major phytoplankton occurring at the sampling stations were nine species of Bacillariophyceae and one of Dinophyceae. 3. In summer, the surface water in eastern Hakata Bay was extremely deficient both N and P or N, especially at the bottom of phytoplankton. 4. The average concentrations of NH4-N, NO3-N, NO2-N, org. N, PO4-P and org. P of the treated sewage effluents used for the N, P enrichment of media were 19.2 3.71, 0.1, 0.94, 2.64 and 0.20 mg/l, and those of bay-mud exudates were 20.8, tr., tr., 1.47, 3.35 and 0.49 mg/l, respectively. 5. In the N, P enriched media with NP-water (NO3-N, 16 mg/l; PO4-P, 2 mg/l), the cell number of almost all phytoplankton species seeded with natural sea water increased with increasing N, P concentrations of the media. In the media enriched with the treated sewage effluent and the bay-mud exudate, however, the growth of most phytoplankton species except Skeletonema costatum and Thalassiosira sp. were inhibited with increasing concentrations of the sewage effluent and the bay-mud exudate in the media. 6. The difference of susceptibility among phytoplankton species to some growth inhibitors which are contained in the sewage effluent and released from the bay-bottom mud may be a factor causing some dominant species in the plankton community. (Author's abstract)
W86-00616

REPLACEMENT OF STENONEMA SPP. BY CAENIS DIMINUTA WALKER AS THE NUMERICAL DOMINANT IN THE MAYFLY ASSEMBLAGE OF A THERMALLY-STRESSED STREAM,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
N. L. Poff, and R. A. Matthews.
Journal of Freshwater Ecology, Vol. 3, No. 1, p 19-26, June, 1985. 3 Fig, 1 Tab, 26 Ref. DOE contract DE-AC09-76SR00001.

Descriptors: *Mayflies, *Thermal pollution, *Species composition, Water pollution effects, Aquatic insects, Streams, Heated water, Effluent.

Mayfly community structures in a thermally-stressed, previously thermally-stressed and an undisturbed stream were compared based on nymphal colonization of leaf packs incubated over a 48 d period from December 1982 to February 1983. Temperatures ranged from 7-31 C in the thermally-stressed stream and from 4-12 C in the other two streams. Accumulated degree days (>OC) were 734, 340 and 322 for the thermally-stressed, post-stressed and undisturbed streams, respectively. Stenonema spp. numerically dominated the mayfly fauna over the sampling period in the undisturbed (70%) and post-stressed (98%) streams, but was replaced by Caenis diminuta Walker (88%) in the stream receiving thermal effluent from a nuclear production reactor. Caenis diminuta is tolerant of rapidly fluctuating (delta T > 11 C/hr) and high temperatures (possibly up to 40 C). (Author's abstract)
W86-00617

EFFECTS OF SEWAGE ON LAKE CHAMPLAIN WETLAND,
Florida Univ., Gainesville. Center for Wetlands.
L. N. Schwartz, and G. K. Gruendling.
Journal of Freshwater Ecology, Vol. 3, No. 1, p 35-46, June, 1985. 1 Fig, 5 Tab, 33 Ref.

Descriptors: *Wastewater pollution, *Wetlands, *Water pollution effects, *Productivity, Food chain, Trophic level, Phytoplankton, Nutrients, Bacteria, Particulate matter, Lake Champlain, New York, Vermont.

Stevens Brook wetland is presently receiving partially treated sewage from the City of St. Albans, Vermont. The water quality in St. Albans Bay is deteriorating. There is conflicting evidence for the theory that wetlands act as a nutrient sink or as a biotic nutrient filter. This research is an investigation into the productivity and trophic food chain relationships of Stevens Brook wetland. This is compared to a non-impacted area, Scomotion Creek Wetland in Plattsburgh, New York. Temperature, pH, dissolved oxygen, transparency, alkalinity, conductivity, sodium, potassium, calcium, magnesium, nitrate, total phosphorus, bacteria, phytoplankton, aquatic macrophytes, and benthic invertebrates were sampled in both wetlands. The data indicate that excessive nutrients and a large carbon source result in high phytoplankton productivity and bacterial growth. This coupled with particulate matter causes low transparency and thus a decrease in submergent vegetation and a decrease in invertebrate faunal diversity. Increased production is not converted to additional biomass of consumers but is exported to the downstream water body. Thus, Stevens Brook wetland appears to be a pass-through system rather than a storage system, and is not effective in tertiary treatment of sewage effluent. (Author's abstract)
W86-00619

DISTRIBUTION OF ALUMINUM IN THE TISSUES OF THREE FISH SPECIES,
Northwestern State Univ. of Louisiana, Natchitoches. Dept. of Biological Sciences.
D. J. Berg, and T. A. Burns.
Journal of Freshwater Ecology, Vol. 3, No. 1, p 113-120, June, 1985. 5 Tab, 18 Ref.

Descriptors: *Aluminum, *Fish, *Alum, *Water pollution effects, Chaplin Lake, Louisiana, Water treatment wastes, Effluents, Catfish, Shad, Largemouth bass.

The use of alum (aluminum sulfate) to decrease the turbidity of public drinking water is a common practice in Louisiana. Alum acts as a source of positive electrolytes which neutralize negatively-charged soil particles, causing them to settle out of the water and produce a gelatinous sludge. Natchitoches, Louisiana pumps approximately 900 kg of such sludge into Chaplin Lake each day. Tissue aluminum levels in channel catfish, gizzard shad and largemouth bass were compared between Chaplin Lake, which receives water treatment plant effluent containing alum and a control lake. No significant correlations were found between tissue aluminum levels and age. Significant negative correlations were found between channel catfish brain and gill aluminum levels in individuals from Chaplin Lake and between gizzard shad brain aluminum levels and standard length. Liver and brain tissues had higher tissue aluminum concentrations than muscle and gill tissues. (Moore-IVI)
W86-00621

INFLUENCE OF OIL REFINERY EFFLUENTS ON THE STRUCTURE OF ALGAL COMMUNITIES,
Udai Pratap Coll., Varanasi (India).Dept. of Botany.
J. P. Gaur, and H. R. Kumar.
Archiv fur Hydrobiologie, Vol. 103, No. 3, p 305-323, May, 1985. 3 Fig, 10 Tab, 44 Ref.

Descriptors: *Water pollution effects, *Refineries, *Industrial wastes, *Algae, Species composition, Algal growth, Wastewater treatment, Plankton, Oil pollution, Phenols.

A survey of algal vegetation and chemical characteristics of wastewaters of Barauni, Gauhati, Gujarat, Madras and Cochin (India) refineries at different stages of treatment was made to have some ideas about the changes in algal community structure along the gradient of decreasing pollution load. During the initial stages of effluent treatment, effluents had high concentrations of oil and phenol as a result of which BOD and COD values were quite high. Several species of Oscillatoria and Phormidium were the sole contributors to total abundance of algal communities in the primary

treatment ponds. Diversity index was around 1 during the initial stage of treatment in oil separator tanks or clarifloculators. With the removal of phenol and oil and lowering of BOD and COD values, some representation of other algae occurred after the passage of effluent through various treatment processes. In conjunction with increase in species number up to the last treatment stage, there was a consistent decrease in apportionment of individuals in each species resulting in high (<3) diversity index at the outfall or the last treatment stage. Selected refineries showed marked resemblance in algal community structure despite the fact that they use different crude oils for refining operations and also different effluent treatment processes, and are located in different states of the country. The algal communities respond in a more or less predictable manner to severe stress of oil pollution. (Baker-IVI)
W86-00623

IN VITRO EFFECT OF MERCURIC CHLORIDE ON ACID AND ALKALINE PHOSPHATASE ACTIVITY OF A FRESHWATER PRAWN,
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
R. Murti, Omkar, and G. S. Shukla.
Archiv fur Hydrobiologie, Vol. 103, No. 3, p 371-374, May, 1985. 2 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Mercuric chloride, *Alkaline phosphatase, *Acid phosphatase, *Prawn, Toxicity, Heavy metals, Mercury compounds.

In vitro experiments were conducted to investigate the effects of mercuric chloride on acid and alkaline phosphatase activity in different tissues of freshwater prawn. Mercury was quite effective, inhibiting the activities of acid and alkaline phosphatases. The degree of inhibition increased with an increase in the concentration of the toxicant. Maximum inhibition in acid phosphatase activity was observed in 0.285 mg/l of mercuric chloride in hepatopancreas as compared to control whereas minimum inhibition was observed in the muscle (13%) after treatment with 0.095 mg/l HgCl2. Alkaline phosphatase activity was inhibited maximum in the stomach (33%) and minimum in the gill (10%) in 0.295 and 0.095 mg/l solutions respectively. In brain no significant inhibition in activity of alkaline phosphatase was noted. Maximum inhibition in acid phosphatase was noted in hepatopancreas (48%). It is concluded that alteration in the activities of these two phosphatases creates disturbances in the normal functioning of the various tissues of M. lamarrei. (Baker-IVI)
W86-00625

EFFECT OF PH ON TOXICITY OF SODIUM PENTACHLOROPHENATE TO FRY OF COMMON CARP IN SOFTWATER,
Delhi Univ. (India). Dept. of Anthropology.
B. S. Khangarot, A. Sehgal, and M. K. Bhasin.
Archiv fur Hydrobiologie, Vol. 103, No. 3, p 375-379, May, 1985. 1 Tab, 23 Ref.

Descriptors: *Water pollution effects, *Carp, *Toxicity, *Sodium pentachlorophenate, *Hydrogen ion conncentration, Organic compounds, Industrial wastes, Pesticides, Fish, Immature growth stages.

Pentachlorophenol and its salts, especially sodium pentachlorophenate (Na-PCP) are used extensively in industry and agriculture as fungicides, bactericides, insecticides and herbicides. Because of their widespread use, these pollutants ultimately reach to the aquaitc ecosystem and create water pollution problems. The acute toxicity of Na-PCP to fry of common carp was examined for 96 hr during bioassay tests. The influence of pH on toxicity of Na-PCP was examined for 48 hr. Most mortality from Na-PCP occurred within the 12 hr period. Immediately upon the introduction of Na-PCP fish showed hyperactivity. The behavioral responses of fry varied according to test concentration and pH. At lower pH, test concentrations are more toxic therefore, test animal showed more behavioral changes as compared to similar higher pH test concentration. In general fry responded to Na-PCP by an increase in swimming activity, surfacing, loss of schooling and equilibrium followed by swimming belly up and finally settling to the bottom before death. At higher pH concentrations fish were not affected until a few hours before death. (Baker-IVI)
W86-00626

EFFECTS OF AVAILABLE DIETARY CARBOHYDRATE AND WATER TEMPERATURE ON THE CHRONIC TOXICITY OF WATERBORNE COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Waterloo Univ. (Ontario). Dept. of Biology.
D. G. Dixon, and J. W. Hilton.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 5, p 1007-1013, May, 1985. 5 Tab, 29 Ref.

Descriptors: *Copper, *Toxicity, *Trout, *Diets, *Carbohydrates, *Water temperature, Heavy metals, Acclimation, Fish, Growth, Mortality.

A factorial design was used to determine the effects of dietary carbohydrate content (0.1 or 25.6%) and temperature (10 or 15 C) on the chronic toxicity of waterborne copper (0 or 144 micro-g Cu/L) to rainbow trout (Salmo gairdneri) over a 12-wk period. Relative to those on the low-carbohydrate (LC) diet, trout reared on the high-carbohydrate (HC) diet developed enlarged, glycogen-filled livers and attained reduced final mean wet body weights. This response was more pronounced at 10 than at 15 C. Whereas Cu exposure had no significant effect on the growth or mortality of either LC or HC fish at 15 C, or LC fish at 10 C, HC fish at 10 C showed significantly reduced final weight and increased mortality. Trends toward reduced liver glycogen and increased serum glucose, characteristic of chronic stress, were apparent in all Cu-exposed fish. In Cu-free water, mean Cu concentrations in liver tissue of HC fish were significantly lower than those in LC fish at both temperatures. Copper exposure resulted in significant increases in liver Cu concentration for all diet treatments except HC at 10 C. Elevated serum sorbitol dehydrogenase levels, indicative of hepatic damage, were apparent in Cu-HC fish at 15 C and in HC, Cu-HC, and Cu-LC fish at 10 C. No treatment effects on either serum protein or hematocrit were evident. The treatments during the growth period affected subsequent lethal tolerance of Cu. While the 96-h Cu LC50 was not significantly altered by diet alone at 15 C, it was elevated in HC fish, relative to LC fish at 10 C. The Cu LC50 of Cu preexposed fish was significantly elevated, relative to parallel groups held in Cu-free water, for LC fish at both 10 and 15 C. This acclimation to Cu was not apparent in HC fish at either temperature: no significant elevation in LC50 occurred as a result of preexposure. It is concluded that increased dietary carbohydrate can significantly increase the chronic toxicity of Cu to trout, and that the impact is enhanced by reduced water temperature. (Author's abstract)
W86-00630

BACTERIOLOGICAL SURVEY OF TWO ACID-STRESSED LAKES IN THE POCONOS BEFORE LIMESTONE APPLICATION,
Lafayette Coll., Easton, PA. Dept. of Biology.
S. K. Majumdar, G. Rall, A. Mrowca, P. Steed, and J. Tabak.
Proceedings of the Pennsylvania Academy of Science, Vol. 58, No. 2, p 181-186, 1984. 7 Tab, 26 Ref.

Descriptors: *White Deer Lake, *Bruce Lake, *Pennsylvania, *Acid rain, *Water pollution effects, *Bacteria, Lake sediments, Lakes, Water analysis, Water temperature, Seasonal variation, Sulfur bacteria.

Water and sediment samples were examined from two acidified lakes (White Deer, water pH range 4.4-6.6, and Bruce Lake, water pH range 5.9-6.6) in the Pocono Mountains of Pennsylvania to assess the impact of acid-stressed conditions on bacterial communities and densities prior to neutralization. Temperature values in water ranged from a low 9.5 in November to a high of 27.6 degre June. In general, for both lakes, as the da and temperature increased, pH values i and bacterial populations, in most cases, in Bacterial counts during the summer and e months were elevated for all types of except for the Pseudomonas types which r consistently low throughout. The bacteri ties showed a seasonal pattern. The nitrog and sulfur cycle bacteria recovered from plate method and the most probable numb dure, showed variations in total bacterial in the water and sediment samples of bo Dear Lake and Bruce Lake. The Pseu bacteria in both lakes were low at all four sites. The sulfur cycle bacteria recovere MPN method also reflected low numb sulfur reducers are found in a moderate ranging from 400 to 52,000 cells per ml of slurry, while the sulfur oxidizers of the dans group which favor a lower pH a prevalent, ranging from a low of 15 in N to a high of 10,000 cells per ml in June. acid stressed lakes in the Poconos are s similar in bacterial communities and dens total bacterial flora present in the two la markedly lower than those found in o acid-stressed lakes. (Baker-IVI)
W86-00634

RESPONSE OF A DETRITAL FOOD EUTROPHICATION,
Marine Biological Lab., Woods Hole, MA
J. E. Hobbie, and J. J. Cole.
Bulletin of Marine Science, Vol. 35, No. 363, November, 1984. 7 Fig, 1 Tab, 18 Re

Descriptors: *Food chains, *Eutrophicat tritus, Bacteria, Protozoa, Marine env Plankton, Nutrients, Nitrogen, Phosphor Biomass, Primary productivity.

The response of planktonic bacteria a protozoa to an experimental eutrophicat ent in coastal marine waters was investig terial and microflagellate numbers, as w tamic acid mineralization and tritiated incorporation, were measured in a serie m mesocosms for 6 months. The system a daily addition of sea water (3.7% of nutrients so that the nutrients added we 16 and 32 times the anthropogenic nitro phorus and silica loading of Narraga Rhode Island. Both the biomass and pr duction of the planktonic algae increase response to nutrient loading through the ment; the response in the 32x treatmen that of the 16x treatment. In general numbers and growth (calculated from uptake) were higher in the more eutro but there were lags in the microbial resp peaks and valleys of the algal growth. caused poor correlation between ins measurements of microbial and algal such as numbers of bacteria and algal p However, when daily production was s the entire 6 months of the study there lent correlation between the total algal and the total bacterial production (r = tanks. It is difficult to convert from incorporation to absolute quantities o production. A conservative conversion rived from laboratory values for the content of bacterial cells was used t bacterial production. Bacterial producti tion plus growth) was nearly a constant planktonic primary production at all le trophication and averaged 31%. The re good agreement with other estimates of flux through the detrital component ecosystems. (Author's abstract)
W86-00638

MACROBENTHIC INVERTEBRAT PERTURBED STREAM IN SOUTHE RIA,
Benin Univ., Benin City (Nigeria). Dep gy.
R. Victor, and D. T. Dickson.
Environmental Pollution (Series A), V

107, 1985. 2 Fig, 1 Tab, 14 Ref.

tors: *Invertebrates, *Benthic fauna, River, *Nigeria, Stress, Oligochaetes, mids, Water pollution effects, Wastewater n, Storm runoff, Aquatic insects.

oba River is a fourth order stream flowing rth to south through Benin City, Bendel outhern Nigeria. In its upper reaches, the lows through a dense rainforest where run-off and organic matter from the sur- vegetation contribute to allochtonous the outskirts of the city, riparian settle- e thinly populated, so that disturbance due n activities is low and localized. The s considerably perturbed while flowing the city. The University of Benin and its Hospital discharge sewage sludge into arings near the right bank and at least part effluents are likely to enter the stream via nd seepage. It also receives stormwater om bordering agricultural lands and ur- areas. The Ikpoba weir impounds the rther downstream to form an artificial A total of nine taxa were collected in the etch. The insects were represented by nymphs of six families: Chironomidae, gonidae, Baetidae, Hydroptilidae, Parni- Corduliidae. The oligochaetes were repre- one family, Naididae. The most striking the study area is the overall low diversi- crobenthic invertebrates. The abundance benthos in the three stations was variable. rtant factors governing the occurrence bution of macrobenthos are the physico- qualities of the water and the immediate of occupation. Any severe alterations of ors will substantially affect the macro- The combination of substrate obliteration water quality, especially the low dis- ygen content seem to be controlling the hos in some instances. (Baker-IVI)
2

FFECTS OF IRON ORE TAILINGS E RESPONSE OF WATERCRESS AILINGS AT HIGH CONCENTRA- FE, ZN AND MN,
Iniv. of Hong Kong, Shatin. Dept. of

g.
ental Pollution (Series A), Vol. 38, No. 0, 1985. 6 Fig, 5 Tab, 14 Ref.

s: *Mine wastes, *Manganese, *Zinc, atercress, Seeds, Metals, Plants, Water ffects, Aquatic plants.

ation growing on iron ore tailings is a harsh environment, especially various aphic factors including the rather high Mn, Fe and Zn. N. officinale (water- vs in waterlogged areas with its roots into the soil and part of the plant body in water. The ability of N. officinale iron ore tailings to produce plants the comparatively high metal concen- s investigated. Samples of watercress cted from the tailings site, a cultivated oncultivated land. Metals present in collected from the tailings were signifi- er than those collected from the other es showed that 5, 10, and 15% water soil from the three sites reduced Brassi- seed germination and root elongation. hree different populations of N. officin- d from the three sites were tested from nce by examination of root growth in a ncentrations of manganese, iron and ely, it was found that the tailings popu- ignificantly higher values of tolerance the three metals despite the fact it had growing on the site for three years.

FOR AQUATIC MULTIPLE SPE- CANT TESTING: ACUTE TOXICITY MICALS TO 5 VERTEBRATES AND BRATES,

Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5A.
W86-00654

FATE AND EFFECTS OF ORGANOTIN COMPOUNDS,
California Univ., Berkeley. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W86-00665

DESTRUCTION OF WATER RESOURCES - THE MOST CRITICAL ECOLOGICAL CRISIS OF EAST ASIA,
International Union for Conservation of Nature and Natural Resources, New Delhi (India).
For primary bibliographic entry see Field 4C.
W86-00666

ALLIUM TEST ON RIVER WATER FROM BRAAN AND SAXAN BEFORE AND AFTER CLOSURE OF A CHEMICAL FACTORY,
Lund Univ. (Sweden). Inst. of Genetics.
For primary bibliographic entry see Field 5A.
W86-00667

GROWTH INHIBITION AND RECOVERY IN MUSSELS (MYTILUS EDULIS) EXPOSED TO LOW COPPER CONCENTRATIONS,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
K. J. Redpath.
Journal of the Marine Biology Association, Vol. 65, No. 2, p 421-431, 1985. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Copper, *Water pollution effects, *Mussels, *Animal growth, Heavy metals, Industrial wastes, Toxicity, Growth, Metals, Animal metabolism.

The shell growth of Mytilus edulis was investigated under the effects of a 10 day exposure to copper at six different concentrations. At concentrations greater than 2 micro g/l added copper, significant growth inhibition occurred. At 15 micro g/l added metal, growth almost ceased. At 6 micro g/l a 50% reduction of growth was noted. After the exposure period was completed, recovery was observed at all concentrations. The long term recovery pattern of Mytilus shell growth was studied after a 20 day exposure to copper also. Evidence was found of a growth overshoot after then end of the exposure period. The known effects of copper on the metabolism of mussels is included in the discussion of these findings. (Baker-IVI)
W86-00668

LONG-TERM ECOSYSTEM STRESS: THE EFFECTS OF YEARS OF EXPERIMENTAL ACIDIFICATION ON A SMALL LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, K. H. Mills, D. F. Malley, D. L. Findlay, and J. A. Shearer.
Science, Vol. 228, No. 4706, p 1395-1401, June 1985. 2 Fig, 45 Ref.

Descriptors: *Water poliution effects, *Acid rain, *Lakes, *Acidification, *Ecosystems, Environmental effects, Fish, Food chains, Acidity, Water quality, Hydrogen ion concentration, Ontario.

An ecosystem scale experiment was conducted in Lake 223, a small Precambrian Shield lake surrounded by virgin boreal forest in the Experimental Lakes Area, and typical of poorly buffered small lakes of northwestern Ontario. Over a period of 8 years, the pH of the lake has been gradually decreased from 6.8 to 5.0 by the addition of sulfuric acid. The study revealed various apparent mechanisms of response of the lake's biota to increased acidity, ranging from direct toxicity of hydrogen ion to disruptions of normal food-chain relations, behavioral patterns of animals, and biogeochemical cycles in the lake. In some cases, synergistic interactions of several stresses appeared to be involved. Some of the adverse changes occurred much earlier in the acidification process than is commonly believed to cause ecosystem degradation. This suggests that ecological damage from lake acidification may be more extensive than previously believed. Changes in phytoplankton species, cessation of fish reproduction, disappearance of the benthic crustaceans, and appearance of filamentous algae in the littoral zone were consistent with deductions from synoptic surveys of lakes in regions of high acid deposition. Acidification did not cause decreases in primary production, rates of decomposition, or nutrient concentrations. Key organisms in the food web leading to lake trout, including Mysis relicta and Pimephales promelas, were eliminated from the lake at pH values as high as 5.8, an indicate that irreversible stresses occur early in the proceess. These changes are caused by hydrogen ion alone, and not by the secondary effect of aluminum toxicity. Since no species of fish reproduced at pH values below 5.4, the lake would become fishless within about a decade on the basis of the natural mortalities of the most long-lived species. (Baker-IVI)
W86-00688

METABOLISM OF ALDRIN BY THE FRESHWATER PLANARIAN PHAGOCATA GRACILIS,
Middle Tennessee State Univ., Murfreesboro. Dept. of Biology.
S. Post, and M. R. Wells.
Bulletin of Environmental Contamination and Toxicology, Vol. 34, No. 6, p 871-875, June, 1985. 1 Tab, 8 Ref.

Descriptors: *Aldrin, *Planaria, *Animal physiology, *Toxicity, Water pollution effects, Enzymes, Dieldrin, Chlorinated hydrocarbons, Pesticides, Insecticides.

Planarians (Phagocata gracilis) that were fed beef liver containing 125 ppm aldrin showed no ill effects and appeared to convert the pesticide to an unidentified hydrophilic compound, not to dieldrin. Planarians sacrificed at 40 min after feeding for 1 hr contained the highest level of aldrin (1.12 + or - 0.99 ppm). Neither dieldrin nor any other insecticide was recovered from tissue. After planarians were removed from the feeding dishes, an unidentified hydrophilic compound, which eluted after 5.35 min from a Varian model 3700 gas chromatograph packed with 11% OV-17+QF, by wt (80/100) on Gas Chrom Q. The compound was recovered from water samples of 2/3 groups sacrificed at 120 min and 3/3 groups sacrificed at 180 min. No aldrin epoxidase activity was detected in any subcellular fraction assayed. P. gracilis does not appear to convert aldrin to dieldrin. The hydrophilic compound detected in water samples from animals treated with aldrin suggests an alternate route of detoxification; this mechanism avoids the formation of another toxic compound by converting aldrin directly into a polar metabolite that is readily excreted into their aquatic environment. (Rochester-IVI)
W86-00693

PCBS IN STRIPED BASS COLLECTED FROM THE HUDSON RIVER, NEW YORK, DURING FALL, 1981,
State Univ. of New York at Albany. Dept. of Atmospheric Science.
R. J. White, H. T. Kim, and J. S. Kim.
Bulletin of Environmental Contamination and Toxicology, Vol. 34, No. 6, p 883-889, June, 1985. 2 Tab, 13 Ref.

Descriptors: *Polychlorinated biphenyls, *Hudson River, *New York, *Bass, *Fish, Bioaccumulation, Water pollution effects, Chlorinated hydrocarbons.

Analyses of striped bass (Morone saxatilis) filets from the Hudson River near Nyack, New York contained a mean concentration of polychlorinated biphenyls (PCBs) higher than 2 ppm. Comparison of peak to peak summation and pattern matching showed that the two techniques gave equivalent results. Trimming fish filets, by removing the skin and adipose tissue, resulted in significantly lower concentrations of PCB (1.3 + or - 0.6 micro-g/g wet weight versus 3.0 + or - 1.8 micro-g/g for the standard filets) from the same fish. Similar results

were obtained for hexane-extractable lipids. No correlation could be established between length of fish and PCB concentration. Trimming of filets reduced the average (but not all individual) tissue concentrations of PCBs to below the 2 ppm limit of safety established by the Food and Drug Administration. It is recommended that anglers employ the trimming procedure and limit the number of fish consumed. (Rochester-IVI)
W86-00695

EFFECTS OF CADMIUM AND COPPER ON CHEMOTAXIS OF MARINE AND FRESHWATER CILIATES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
S. G. Berk, J. H. Gunderson, and L. A. Derk.
Bulletin of Environmental Contamination and Toxicology, Vol. 34, No. 6, p 897-903, June, 1985. 2 Tab, 16 Ref. U.S. EPA grant R809799.

Descriptors: *Protozoans, *Copper, *Cadmium, *Chemotaxis, *Animal behavior, *Water pollution effects, Metals, Heavy metals, Toxicity.

The chemotactic response of both freshwater and marine ciliates was affected by the presence of relatively low concentrations of copper or cadmium in the water. Ciliates (Tetrahymena sp., freshwater; Paranophrys sp., an unknown designated W5, and Maimiensis avidus; all marine) were allowed to seek yeast extract solution in capillary tubes, and the number of ciliates entering the tubes was measured. Copper caused swimming speed to increase, which gave the impression of stimulated chemotaxis, but in fact led to non-linear log-probit graphs for EC50, yielding meaningless values in some cases. Significant inhibition of chemotaxis was given by copper at 0.0050-0.25 ppm (Miamensis), 0.05-0.10 ppm (Paranophrys), 0.05-1.0 ppm (W5), and 0.25-1.00 (Tetrahymena) and by cadmium at 0.25-1.00 ppm (Tetrahymena), 4.0-25.0 ppm (Paranophrys), 5.0-25.0 (W5), and 10.0-25.0 ppm (Miamiensis). Copper was apparently more toxic than cadmium for marine ciliates, and the metals were equally toxic for the freshwater species. The inhibitory effects on Miamiensis of 15 min exposure to 0.5 ppm Cu were eliminated by washing the cells; similarly, the effects of Cd could be reversed by washing. Washing Tetrahymena did not eliminate the effects of exposure to 0.25 ppm Cu, but did nullify the effect of 1 ppm Cd. Sublethal concentrations of certain heavy metals in the natural environment may cause population reduction or elimination because animals become unable to locate areas of high food concentration. (Rochester-IVI)
W86-00696

TOXICITY AND ACCUMULATION OF COPPER AND CADMIUM IN THE ALGA SCENEDESMUS OBLIQUUS LH,
Vysoka Skola Zemedelska v Praze, Ceske Budejovice (Czechoslovakia). Faculty of Agricultural Economics and Management.
K. Drbal, K. Veber, and J. Zahradnik.
Bulletin of Environmental Contamination and Toxicology, Vol. 34, No. 6, p 904-908, June, 1985. 2 Tab, 12 Ref.

Descriptors: *Algae, *Scenedesmus, *Toxicity, *Bioaccumulation, *Copper, *Cadmium, Metals, Heavy metals, Water pollution effects, Chemical reactions.

Scenedesmus obliquus LH removes both Cu and Cd from an aquatic medium, but actual bioabsorption appears to be much lower than measured changes of the metals in the cultivation media. Initial experiments showed a removal efficiency of 83-97% for Cu and 78-99% for Cd when calculated on the basis of amount of heavy metal remaining in the supernatant medium. In parallel experiments without algae and without light, however, removal of 47-56% Cu and 61-78% Cd was observed, indicating that purely chemical precipitation accounted for much of the observed removal of metals. Studies conducted over periods ranging from 0.5-120 or 144 hr showed that removal efficiency generally increased between 0.5 and 24 hr for both metals in all experiments, but did not necessarily increase with increasing time after that. In all series, the removal efficiency at 120 or 144 hr was less than values attained at shorter times. The presence of 0.5 mg/l of each metal in the medium produced less inhibition of biomass accumulation over time than did 1 mg/l of each metal in the culture. Microscopic examinations showed no death of algal cells at either concentration in experiments lasting up to 144 hr. The inhibitory effect of Cu and Cd on the growth of S. obliquus at initial biomass concentrations of about 2 g/l dry wt is perceptible, and the algae apparently accelerate and increase the removal of copper and cadmium from the medium. (Rochester-IVI)
W86-00697

USE OF WATERSHED CHARACTERISTICS TO SELECT CONTROL STREAMS FOR ESTIMATING EFFECTS OF METAL MINING WASTES ON EXTENSIVELY DISTURBED STREAMS,
Illinois Univ. at Urbana-Champaign. Dept. of Ecology, Ethology and Evolution.
R. M. Hughes.
Environmental Management, Vol. 9, No. 3, p 253-262, 1985. 4 Fig, 3 Tab, 35 Ref. EPA grant R806391.

Descriptors: *Mine wastes, *Water pollution effects, *Streams, *Controls, *Watersheds, Sediments, Heavy metals, Stream pollution, Trout, Riparian vegetation, Invertebrates, Habitats.

Impacts of sediments and heavy metals on the biota of streams in the copper-mining district of southwestern Montana were examined by comparing aquatic communities of impacted streams with those of control streams. Control streams were chosen through the use of a technique that identifies similar streams based on similarities in their watershed characteristics. Signficant differences between impacted and control sites existed for surface substrate, riparian vegetation, and the number of macroinvertebrate taxa. These results revealed that: (a) chemical and physical habitats at the impacted sites were disrupted, (b) the presence of trout was an inadequate measure of ecological integrity for these sites, and (c) watershed classification based on a combination of mapped terrestrial characteristics provided a reasonable method to select control sites where potential control sites upstream and downstream were unsuitable. (Author's abstract)
W86-00725

SEPARATING STARVATION LOSSES FROM OTHER EARLY FEEDING FRY MORTALITY IN STEELHEAD TROUT SALMO GAIRDNERI, CHINOOK SALMON ONCORHYNCHUS TSHAWYTSCHA, AND LAKE TROUT SALVELINUS NAMAYCUSH,
New York State Dept. of Environmental Conservation, Albany. Bureau of Environmental Protection.
J. C. Skea, J. Symula, and J. Miccoli.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 1, p 82-91, July, 1985. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Starvation, *Mortality, *Trout, *Salmon, *Fish hatcheries, *DDT, *Fish toxicants, Fish physiology, Growth, Syndrome, Aquaculture.

Calculating time of exposure in terms of temperature units (TU = temperature in degrees C x hours at temperature / 24) made it possible to show that death of fry due to starvation occurred at a significantly different time from death due to toxic (DDT) syndrome in steelhead trout, lake trout, and chinook salmon from various water bodies in New York and Lake Michigan. This DDT syndrome, a condition which has been observed since 1964 in some species, includes death of fry characterized by distended air bladder, air in the intestinal tract, and erratic swimming. When unfed fish were separated according to source female, and held without feeding, death from DDT syndrome occurred in a peak occurring within approx 300 TU from 50% swim-up, regardless of the length of time required to reach this stage of maturation. The losses were female-dependent in steelhead trout. salmon from Lake Ontario did not exh drome, but steelhead trout from this lake peak of mortality from starvation cam hundred TU after the peak associated w syndrome, and the appearance of fish syndrome was very different from that dying of starvation. DDT syndrome loss, female-dependent, may result from pest nutritional deficiencies during oogenesis a tellogenesis; mortality that occurs after th can be correlated with poor fry diet cultural causes. Recognition of the tempo ration of DDT syndrome losses from di has already resulted in significant saving duction costs in the New York State system. (Rochester-IVI)
W86-00728

NITRITE EXPOSURE AND RESPI RATES IN FATHEAD MINNOWS,
North Texas State Univ., Denton. Dept. ical Sciences.
D. E. Watenpaugh, and T. L. Beitinger.
Bulletin of Environmental Contamina Toxicology, Vol. 35, No. 1, p 106-111, J 1 Tab, 26 Ref.

Descriptors: *Nitrites, *Respiration rat nows, *Toxicity, Water pollution effe Hardness, Oxygen consumption, Fish pl Animal physiology.

Acute exposure of fathead minnows (P promelas) to nitrite reduced their weig oxygen consumption by about 22%. Acu static exposures of fish to nitrite were co aerated, reconstituted hard water at 19 + Minnows used weighed 0.60 + or - 0. nominal doses of 0, 9, 18, and 27 mg were employed, with replications of 15-2 replicate. Routine respirometry mea were conducted with individual fish i bottles closed for 90 min at 19.2 + o Some fish died during exposure to n during subsequent respirometry; both mortality were significantly correlated w level. Most fish were minimally active spirometry; severely stressed fish were less active. Mean weights of minnows various nitrite concentrations were not s ly different. Although mean routine rate of minnows at the lowest nitrite were not significantly lower than that c trols, the rates of the fish receiving the t nitrite exposures were significantly lowe controls. Although routine respiration minations detected a sublethal effect of n determinations are usually insensitive in changes in metabolic rate induced by because activity is unregulated. Effects cals on metabolic rate are better evalu standard or active weight-specific ox sumption when possible. (Rochester-IVI
W86-00729

RESPONSES OF MACROBENTHO NIZING ESTUARINE SEDIMENTS C NATED WITH DRILLING MUD CON DIESEL OIL,
Environmental Research Lab., Gulf B
M. E. Tagatz, G. R. Plaia, and C. H. De
Bulletin of Environmental Contamin Toxicology, Vol. 35, No. 1, p 112-120, 2 Tab, 20 Ref.

Descriptors: *Macrobenthos, *Estuarin ment, *Sediments, *Drilling mud, *F pollution effects, Mollusks, Annelids, Arthropoda, Barium sulfate, Lime, Spec sition, Ecological effects.

Communities of macrobenthos formin colonized boxes containing drilling mu nated with diesel oil differed significant of numbers of individuals, numbers of s phylogenetic composition from boxes clean sand. Acrylic plastic boxes (32 x deep) were positioned flush with bottom surface at 3 m depth in Santa

da). They were filled with clean sediment, nt containing lime drilling mud with 3.98 wet weight diesel oil, or sediment containing sulfate. Colonization was permitted for 8 d all animals retained on a 1-mm mesh sieve ounted. A total of 1,081 animals represent- species and 10 phyla were collected. Mol- Annelida, Chordata, and Arthropoda were minant phyla. Only 24 and 32 spp occurred 1:3 and 1:10 lime-mud:sediment mixtures, ively, compared to 43 spp in the control. ks, particularly gastropods, and annelids ignificantly affected. Although individuals ecies were fewer in barite mixtures than in ntrol, only the species effect for combined n 1:3 barite:sediment was significant. For all combined, both the number of individuals nber of species in 1:3 mud mixtures differed antly from those in barite mixtures; a signifi- ference in number of species was detected n the 1:10 mud mixtures and 1:10 barite s. Species diversity, species dominance, and arity indices changed markedly only in nities exposed to 1:3 mud mixtures. Relative ce of individual species for all treatments little from the control, as reflected by low rtis dissimilarity indices; however, com- in 1:3 mud were most dissimilar. Indices ed comparing the control with 1:10 barite, e, 1:10 mud, and 1:3 mud were 0.17, 0.20, d 0.31, respectively. Species number and were more sensitive and reliable indicators s than the biological indices employed. ter-IVI)
730

AND CHRONIC TOXICITY OF TECH- PICLORAM (4-AMINO-3,5,6-TRICH- ICOLINIC ACID) TO DAPHNIA STRAUS,
emical U.S.A., Midland, MI. Mamamma- Environmental Toxicology.
rsich, D. L. Hopkins, and D. P. Milazzo. of Environmental Contamination and gy, Vol. 35, No. 1, p 121-126, July, 1985. Ref.

ors: *Toxicity, *Picloram, *Herbicides, a, Water pollution effects, Bioassays, Pes-

8 hr) and chronic (21 day) toxicity studies herbicide compound picloram (4-amino- loropicolinic acid) indicate a compara- w toxicity for the cladoceran Daphnia traus. In the acute test, groups of 10 were exposed to 12.7, 20.5, 34.5, 57.0, and picloram; in the chronic test, neonates wed to grow and reproduce in glass tubes ns of 7.6, 11.8, 18.1, 29.6, and 46.9 mg/l The calculated 48-hr LC50 value was (63.0-75.0 = 95% confidence interval). ll and 100% kill levels were 34.5 and 94.4 pectively. The maximum acceptable toxi- centration (MATC: based on mean total ult) estimated from the chronic study as between 11.8 and 18.1 mg/l; the geo- ean value was 14.6 mg/l. Mean dry lult was not statistically analyzed, nor ed to estimate the MATC. The control weight/adult was 600 micro-g; all pi- ated daphnids had a mean dry weight/ 00 micro-g, except the highest concentra- mg/l, for which the value was 300 The survival in the chronic test was from % for the control and all picloram con- s up to 29.6 mg/l, but was 60% for the treatment (statistically significant at the . (Rochester-IVI)
1

T MORTALITIES AND LC50 VALUES LECTED MICROCRUSTACEANS EX- O TREFLAN, CUTRINE-PLUS, AND ERBICIDES,
Univ., Baton Rouge, LA. Dept. of Bio- ences.
vi, V. O. Davis, and R. M. Hawkins. f Environmental and Toxicology, Vol. p 127-132, July, 1985. 2 Tab, 11 Ref. Board of Regents, Research and Devel- opment Program project B-17.

Descriptors: *Herbicides, *Crustaceans, *Trifluralin, *Cutrine-plus, *Monosodium methanearsonate, *Toxicity, Water pollution effects, Arsenicals, Pesticides, Cladocerans, Calanoidians, Cyclopods, Ostracods,.

Three herbicides, Treflan (trifluralin), Cutrine-plus, and monosodium methanearsonate (MSMA), were shown to be toxic to a mixture of freshwater zooplankton collected in Lake Kernan, Louisiana. Treflan was much more toxic than the other two substances. LC50 values for Treflan (ppm) were as follows: Cladocera, 0.06; Calanoida, 0.08; Cyclopoida, 0.05; and Ostracoda, 0.06. Comparable values for Cutrine-plus were 11.3 12.21, 12.4, and 12.5, respectively, at a CaCO3 hardness of 140 mg/l. For the same compound at 280 mg/l CaCO3 hardness, respective LC50 values were raised to 18.5, 12.6, 16.4, and 15.3 ppm. MSMA was least toxic, with 48-hr LC50 values of 39.3, 37.6, 96.3, and 98.2 ppm, respectively, for Cladocera, Calanoida, Cyclopoida, and Ostracoda. Forty-eight-hour LC99 values for all microcrustacean groups together were 1.3-1.9 ppm for Treflan, 28.4-37.7 ppm for Cutrine-plus in soft water, 40.4-80.5 ppm for Cutrine-plus in medium hard water, 33.4-129.1 ppm for Cutrine-plus in very hard water, and 133.9-781.2 ppm for MSMA. Microcrustaceans were identified only to generic level (Alonella sp., Cladocera; Diaptomus sp., Calanoida; Eucyclops sp., Cyclopoida; and Cypria sp., Ostracoda). (Rochester-IVI)
W86-00732

AQUATIC BIOASSAY OF 11 PESTICIDES USING LARVAE OF THE MOSQUITO, WYEOMYIA SMITHII (DIPTERA: CULICIDAE),
Air Force Occupational and Environmental Health Lab., Brooks AFB, TX.
For primary bibliographic entry see Field 5A.
W86-00733

ENVIRONMENTAL AND ECONOMIC DAMAGE CAUSED BY SEDIMENT FROM AGRICULTURAL NONPOINT SOURCES,
Tennessee Valley Authority, Knoxville. Environmental Quality Staff.
A. M. Duda.
Water Resources Bulletin, Vol. 21, No. 2, p 225-234, April, 1985. 3 Fig, 1 Tab, 56 Ref.

Descriptors: *Nonpoint pollution sources, *Sediments, *Water pollution effects, Water quality, Agriculture, Soil erosion, Economic aspects, Environmental effects.

Environmental and economic damages caused by agricultural nonpoint source inputs of sediment and associated pollutants are examined. Widespread water quality problems are identified in lakes, rivers, and estuaries in agricultural areas, and billions of dollars of onsite and offsite costs result from this eroded soil every year. Some water bodies have been irretrievably damaged, and expensive rehabilitation programs are needed to remedy in-place water pollution problems if Clean Water Act goals are to be achieved. Unless effective abatement and rehabilitation programs are established, billions of dollars of benefits to future generations will not be realized as more waters become irretrievably damaged, and billions more will continue to be spent by government to treat symptoms of these sediment-related problems. (Author's abstract)
W86-00784

GOLD-MINING EFFECTS ON STREAM HYDROLOGY AND WATER QUALITY, CIRCLE QUADRANGLE, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 4C.
W86-00785

GOLD-MINING EFFECTS ON HEAVY METALS IN STREAMS, CIRCLE QUADRANGLE, ALASKA,
Alaska Cooperative Fishery Research Unit, Fairbanks.
J. D. LaPerriere, S. M. Wagener, and D. M. Bjerklie.
Water Resources Bulletin, Vol. 21, No. 2, p 245-252, April, 1985. 1 Fig, 7 Tab, 9 Ref. EPA project 808340-01.

Descriptors: *Gold mining, *Heavy metals, *Stream pollution, *Circle Quadrangle, *Alaska, Placer mining, Mine wastes, Arsenic, Mercury, Lead, Zinc, Copper, Cadmium, Water pollution effects.

Placer gold mining, which extracts gold from buried or exposed alluvia, is often conducted on or near streams. Such mining has the potential to adversely affect water quality. Other heavy metals associated with the gold (such as arsenic, cadmium, lead, zinc, and copper) may be freed to enter streams. Mercury may also enter streams if miners are using it to recover fine particles of gold. These heavy metals are toxic and thus may be harmful to the aquatic life of the streams receiving effluent or runoff from placer mines. In 1982 two streams were sampled intensively - one heavily mined and one unmined - for total recoverable arsenic, mercury, lead, zinc, and copper. Only mercury was not significantly higher in concentration in the mined streams. In 1983 two stream pairs were sampled three times, and 10 other sites at least once, for total and dissolved arsenic, cadmium, mercury, lead, zinc, and copper. Mercury and cadmium were not significantly elevated in mined streams, but the concentrations of total arsenic, lead, zinc, and copper, and dissolved arsenic and zinc were significantly higher in streams below active placer mining sites, than in these that were not being mined or those that had never been mined. Additionally, total arsenic, lead, zinc, and copper and dissolved arsenic and copper became elevated after mining began in 1983 on a previously unmined stream. (Author's abstract)
W86-00786

DISTRIBUTION AND PERSISTENCE OF AMINOCARB IN STREAM WATER, SEDIMENT AND FISH AFTER APPLICATION OF THREE MATACIL FORMULATIONS,
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
For primary bibliographic entry see Field 5B.
W86-00811

RELATIONSHIPS BETWEEN SURFACE SEDIMENT DIATOM ASSEMBLAGES AND LAKEWATER CHARACTERISTICS IN ADIRONDACK LAKES,
Indiana Univ. at Bloomington. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W86-00829

VIRAL POLLUTION OF THE MARINE ENVIRONMENT,
Minnesota Univ., St. Paul. Coll. of Veterinary Medicine.
For primary bibliographic entry see Field 5B.
W86-00851

ASBESTOS IN DRINKING WATER
Department of National Health and Welfare, Ottawa (Ontario). Health Protection Branch.
For primary bibliographic entry see Field 5B.
W86-00853

EFFECT OF ACID RAIN ON SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
M. A. Tabatabai.
CRC Critical Reviews in Environmental Control, Vol. 15, No. 1, p 65-110. 8 Fig, 11 Tab, 166 Ref.

Descriptors: *Acid rain, *Soil chemistry, *Water pollution effects, *Acidity, Source of pollutants, Nutrients, Nitrogen, Sulfur, Ammonium, Fertilizers.

Soil reaction and pH, factors affecting soil formation, sources and forms of acidity in soils, the effect

of soil pH on soil chemical and biochemical properties, the sources, forms and importance of acidity in precipitation, and deposition of macro- and micronutrients on soils in precipitation are reviewed. Soil formation is an acidifying process that involves dynamic chemical and biochemical equilibria. The sources of acidity in soils include H2CO3 formed from high CO2 concentrations in the soil atmosphere produced from root and microbial respiration, acidity produced in mineralization of organic N and S, N fixation by leguminous plants, NH4(+)-forming fertilizers, organic acids produced from crop residue and litter decomposition, and, in addition, precipitation. Additions of acidity in precipitation to soils are insignificant in comparison with the acidity produced in natural processes and by agricultural soil amendments. Information obtained to date indicates that acid rain has not adversely affected soils. Dry deposition and acid dew and fog formation near point source pollution sites, however, may cause greater acidification of soils and therefore deserve investigation. Addition to soils of trace elements and heavy metals by acid precipitation is not significant relative to the amounts present in soils and added in fertilizers, animal manure, and municipal sludges. Significant acidification of soils may lead to greater mobility of these elements in the environment. The pronounced intrinsic buffering capacity provided by soil minerals and organic matter tends to minimize changes in pH of soils receiving acid precipitation. The amounts of N and S added by precipitation are beneficial to agricultural, forested, and unmanaged soils. The amounts of other macro- and micronutrients added to soils in precipitation are insignificant compared with those present in soil systems. (Rochester-IVI)
W86-00858

EFFECT OF FLOODING OF SOIL ON GROWTH AND SUBSEQUENT RESPONSES OF TAXODIUM DISTICHUM SEEDLINGS TO SO2,
Wisconsin Univ.-Madison. Dept. of Forestry.
J. Shanklin, and T. T. Kozlowski.
Environmental Pollution (Series A), Vol. 38, No. 3, p 199-212, 1985. 3 Tab, 38 Ref.

Descriptors: *Flooding, *Soil water, *Plant growth, *Sulfur dioxide, *Trees, Plant physiology, Water pollution effects, Plant tissues, Acid rain.

Unflooded and flooded, twelve-week-old Taxodium distichum (L.) Rich seedlings were grown for eight weeks in a growth chamber and then exposed to 0, 0.5, 1.0 or 1.5 micro-l/l SO2 for 48h. The seedlings were grown in the glasshouse for an additional six weeks. Flooding with stagnant water decreased the rate of height growth, needle initiation and expansion, and dry weight increment of leaves and roots, but not stems. Flooding of unfumigated seedlings for an additional six weeks also significantly reduced dry weight increment of stems. The greater reduction in root growth over shoot growth in flooded seedlings will tend to create leaf water deficits and predispose seedlings to drought injury when the flood waters recede. Exposure to SO2 at 1.0 micro-l/l or higher concentration reduced growth in both previously unflooded or flooded seedlings, but growth was reduced more in the unflooded seedlings which absorbed more S. Growth of seedlings was reduced more by flooding than by SO2. A significant flooding-SO2 interaction on dry weight increment of leaves, but not roots or stems, was shown. The effects of flooding and SO2 on growth differed when based on analysis of dry weight increment or relative growth rates of seedlings. Greater standardization of methods of determining plant responses to pollution is needed. (Author's abstract)
W86-00861

EFFECTS OF MUNICIPAL SLUDGE AND FERTILIZER ON HEAVY METAL ACCUMULATION IN EARTHWORMS,
Miami Univ., Oxford, OH. Dept. of Zoology.
E. A. Kruse, and G. W. Barrett.
Environmental Pollution (Series A), Vol. 38, No. 3, p 235-244, 1985. 3 Tab, 29 Ref. EPA grant R-807370-01.

Descriptors: *Land disposal, *Heavy metals, *Earthworms, *Environmental effects, *Fertilizer, *Sludge disposal, Cadmium, Copper, Lead, Zinc, Metals, Bioaccumulation.

Comparisons were made of heavy metal concentrations of cadmium, copper, lead, and zinc in Lumbricus rubellus collected from a three-year-old field community in which replicate plots were treated five times annually for four years with either fertilizer, sewage sludge, or left untreated as controls. Concentrations of all four metals were significantly higher ($P < \text{or} = 0.05$) in the soil from sludge-treated plots than from fertilizer or control plots. Cadmium concentration was approximately nine times greater in earthworms from sludge plots than in those from control or fertilizer plots. Although amounts of copper (mean = 20.7 micro-g/g) and lead (8.75 micro-g/g) were also significantly higher in earthworm tissue from sludge-amended communities as compared to fertilizer or control treatments, concentration factors were relatively low, suggesting possible biological regulation of these metals. No significant differences were found between treatments for zinc concentrations in earthworm tissue. Lumbricus rubellus appears to be an ideal indicator species for investigating rates of heavy metal uptake within terrestrial ecosystems. (Author's abstract)
W86-00862

ENVIRONMENTAL IMPACT OF PAPER MILL WASTE DISCHARGES TO THE SWALE,
Southern Water Authority, Chatham (England). Kent Div.
R. A. Dines, and J. R. Wharfe.
Environmental Pollution (Series A), Vol. 38, No. 3, p 245-260, 1985. 7 Fig, 1 Tab, 18 Ref.

Descriptors: *Pulp and paper industry, *Industrial wastewater, *Swale, *England, *Water pollution effects, Wastewater pollution, Sediments, Suspended solids, Benthos, Anaerobic conditions.

The Swale is a tidal channel on the southeast coast of England, which has international significance as a wildlife refuge and, until the 1930s, supported a major oyster fishery. Disposal of paper mill wastes over many years has now degraded the marine environment to such an extent that pollution abatement measures are imperative. This study was carried out in order to predict the effects of such measures and to assess the current impact of the discharges. Surveys of the soft sediment fauna, together with sediment redox profiles, organic carbon and cellulose content, showed that the fauna is impoverished with the most severe effects in Milton Creek, which joins the Swale close to the major waste discharge. In the main channel the blanketing effect of a high suspended solid load is considered to be responsible, and this should respond rapidly to improvements in effluent quality. In the creek, however, the sediments are highly reduced and recovery would probably be very slow. (Author's abstract)
W86-00863

QUANTITATIVE STRUCTURE-TOXICITY RELATIONSHIPS WITH OSMOTICALLY STRESSED ARTEMIA SALINA NAUPLII,
California State Univ., Hayward. Dept. of Biological Sciences.
G. D. Foster, and R. E. Tullis.
Environmental Pollution (Series A), Vol. 38, No. 3, p 273-281, 1985. 2 Tab, 13 Ref.

Descriptors: *Toxicity, *Osmotic pressure, *Shrimp, *Partition coefficients, Water pollution effects, Bioassays, Salinity, Organic compounds.

Aquatic animals subjected to osmotic stress may show an increased toxicity response to water contaminants. Artemia salina cysts were hatched and raised in 50% or 25% artificial seawater at 19 C and the resulting Stage II nauplii were exposed to various organic chemicals to determine immobilization concentrations (IC sub 50 :24h). Simple linear regressions were used to compare the 50% immobilization concentration (IC sub 50) values at both salinities to n-octanol water partition coefficients. The fundamental equation is described by log 1/IC sub 50 = a + b x log P. Posit regressions were observed at both salinitie ing a nonspecific-type toxicity. The regre correlation parameters were not signific ferent between the two relationships. As ty was decreased, however, the inter creased and the slopes decreased in a consistent fashion. The present quantitati appears to be relatively insensitive to c the toxicity of organic chemicals to or stressed A. salina nauplii. (Author's abstra W86-00864

EFFECT OF SAFE CONCENTRATI SOME PESTICIDES ON OVARIAN DESCENCE IN THE FRESHWATER N CHANNA PUNCTATUS (BL.): A QU TIVE STUDY,
Punjab Agricultural Univ., Ludhiana Dept. of Zoology.
K. Mani, and P. K. Saxena.
Ecotoxicology and Environmental Safet No. 3, p 241-249, June, 1985. 3 Tab

Descriptors: *Carbofuran, *Fenitrothio cide toxicity, *Reproduction, *Murrels, icity, Spawning, Organophosphorus Carbamate pesticides.

The effects of safe concentrations of c 3% G (5 ppm) and fenitrothion 30% ppm) on ovarian recrudescence of Chan tus during the maturing, prespawning, a ing phases (mid-April through mid-Aug annual reproduction cycle were studied sults reveal that, compared to carbofu ment, fenitrothion was more effective n lowering ovarian weights, but also in ret growth of previtellogenic (stage I) oo vitellogenic (stage II) and yolky (stag cytes. In addition, more previtellogenic logenic oocytes underwent atresia in fe treated fish and only atretic oocytes wer in the ovaries of these fish after 120 day sure. The fenitrothion treatment also ca nificant decline in the diameter of sta cytes, and in the number of nucleoli oocytes. (Author's abstract)
W86-00872

FISH PHYSIOLOGY AND METAL TION: RESULTS AND EXPERIENC LABORATORY AND FIELD STUDIES
National Swedish Environment Protect Nykoeping. Brackish Water Toxicology
A. Larsson, C. Haux, and M. L. Sjobeck
Ecotoxicology and Environmental Safe No. 3, p 250-281, June, 1985. 5 Fig, 2 Ta

Descriptors: *Fish physiology, *Water effects, *Metals, Toxicity, Seasonal var zymes, Metabolism, Sweden.

Many physiological methods can be very revealing adverse toxic effects of pollut at low exposure levels. Such diagnosti also be applied to fish in a complex fiel Physiological methods were applied to living in metal-polluted waters. The fish perch, whitefish and fourhorn sculpin fi ed and unpolluted lakes, rivers and coa of Sweden. The results and experience field application show that certain clinic may be very useful in detecting and sublethal disturbances in natural fish po polluted areas. There is a good agreeme metal-induced physiological effects dete exposed under natural field conditions found in laboratory experiments. Variat sex and body size, selection of samplin and the season are essential factors w however, be taken into account in ph field studies. The aberrant values for se ological parameters in fish from metal-e ed waters indicate that the metal poll profound influence on important ph functions, such as the immune defense, and glucose homeostasis. Among the tes logical variables, the erythrocyte delta- linic acid dehydratase activity and the v

eem to be the most promising indicators of
ollution. (Moore-IVI)
0873

T-TERM TEST FOR PREDICTING THE
NTIAL OF XENOBIOTICS TO IMPAIR
ODUCTIVE SUCCESS IN FISH,
h Environmental Research Inst., Stock-

mary bibliographic entry see Field 5A.
0874

TOXICITY OF MIXTURES OF
PS OF ORGANIC AQUATIC POLLUT-
TO THE GUPPY (POECILIA RETICU-

Rijksuniversiteit (Netherlands). Dept. of
ary Pharmacology, Pharmacy and Toxicol-

ens, P. Leeuwangh, and A. Musch.
cology and Environmental Safety, Vol. 9,
p 321-326, June, 1985. 5 Tab, 10 Ref.

tors: *Water pollution effects, *Toxicity,
c compounds, *Guppies, Chloroanilines,
henols, Halogenated hydrocarbons, Fish.

tudy acute lethal concentrations (LC50) to
py (Poecilia reticulata) were determined
ures of 4 groups of aquatic pollutants. The
were composed of 11 nonreactive, nonion-
anic chemicals, 11 chloroanilines, 11 chlor-
, and 9 reactive organic halides. Earlier
ndicated that the joint toxicity within each
groups was concentration additive, prob-
ause of a similar mode of action. The joint
of combinations of one representative from
up showed a high variance, but generally
o be partially additive to concentration
This high variance is probably caused by
number of compounds in these mixtures.
ents with mixtures of whole groups gave
curate results. The toxicity of a mixture of
three groups, containing 33 well-known
ollutants, was almost completely concen-
ddditive. Concentrations of 0.04 of the indi-
C50 values contributed to the toxicity of
ure. (Author's abstract)
76

LE OF INTERACTION BETWEEN EN-
MENTAL POLLUTANTS: MODIFICA-
F THIRAM TOXICITY TO FRESHWA-
RGANISMS BY NITRITES OR NI-
IN RELATION TO NITROSAMINE
CSIS,
Univ., Mont-Saint-Aignan (France). Lab.
ologie.
any, R. Truhaut, P. Vasseur, D. Klein,
Ferard.
ology and Environmental Safety, Vol. 9,
327-338, June, 1985. 8 Fig, 3 Tab, 16 Ref.
des Recherches, Etudes et Techniques
DRET 78/299.

rs: *Thiram, *Toxicity, *Nitrites, *Ni-
itrosamines, Water pollution effects, Fun-
Carbamates, Chlorella, Daphnia, Carp,
nio, Food chains, Fate of pollutants, Car-
Algae.

dithiocarbamate fungicide, is known to
dimethylnitrosamine (DMNA) when as-
vith nitrites. Conditions of appearance of
nogenic compound have been studied in
experiments by association of the fungi-
tes or nitrites, and species representative
ater biota. DMNA has been estimated by
ipped with a specific detector. Chlorella
an rapidly produce nitrites from nitrates
NA is obtained in presence of thiram.
magna can also synthesize DMNA but
ve to be added to the medium. Increased
thiram is observed. The same results are
on Cyprinus carpio and for a part on
nio rerio. When the species are associated
y experimental food chain, and intoxicat-
eed the two other levels, no significant
observed. Nevertheless, some DMNA
y exist for particular species exposed to thiram associated with nitrites or even nitrates if algae are present. (Author's abstract)
W86-00877

METHYL PARATHION (O-O-DIMETHYL O-4-NITROPHENYL THIOPHOSPHATE) EFFECTS ON WHOLE-BODY AND TISSUE RESPIRATION IN THE TELEOST, TILAPIA MOSSAMBICA (PETERS),
Sri Venkateswara Univ., Tirupati (India). Dept. of Zoology.
K. S. Prasada Rao, I. K. Ahammad Sahib, and K. V. Ramana Rao.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, P 339-345, June, 1985. 3 Tab, 16 Ref. UGC grant F-30-49/77.

Descriptors: *Methyl parathion, *Respiration, *Tilapia, *Toxicity, Water pollution effects, Fish, Organophosphorus pesticides, Oxygen consumption, Enzymes.

The respiratory parameters of an animal are important physiological processes for assessing toxic stress, because they are valuable indicators of function of all vital life-sustaining processes. Respiratory parameters of the freshwater teleost, Tilapia mossambica, exposed to the organophosphorus pesticide methyl parathion were studied. The fish were exposed at 0.09 ppm methyl parathion, which represents a sublethal level of about one-third of the 48 hr LC50 value. The rate of oxygen consumption by whole fish and selected tissues decreased during a 48-hr time-course study. The activities of the respiratory enzymes succinate dehydrogenase, malate dehydrogenase, and cytochrome-c oxidase also decreased considerably under methyl parathion exposure in muscle, gill, liver and brain tissues. Methyl parathion, even at sublethal concentrations, has a profound effect on the oxidative metabolism of the fish, possibly due to its influence on the respiratory center of the brain. (Moore-IVI)
W86-00878

STUDIES ON THE SEQUENCE OF 2,6-DIISOPROPYLNAPHTHALENE METABOLITE FORMATION USING CARP HEPATOCYTE,
Tokyo Univ. of Fisheries (Japan). Dept. of Marine Environmental Science and Technology.
H. Kojima, M. Tanaka, and T. Yoshida.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, p 364-368, June, 1985. 4 Fig, 10 Ref.

Descriptors: *Carp, *Diisopropylnaphthalene, *Metabolism, *Hepatocytes, Water pollution effects, Toxicity, Naphthlalenes, Fish.

The effects of chemical substances on aquatic organisms are of great concern in ecotoxicological study. Studies on xenobiotic metabolism in fish are of importance. Xenobiotics are metabolized mainly in hepatic microsomes and catalyzed by the cytochrome P-450-mediated mixed-function oxidase system in mammals as well as in fish. Metabolism of 2,6-diisopropylnaphthalene (2,6-DIPN) was studied in freshly isolated carp hepatocytes. The viability of the isolated hepatocytes was 93%. 2,6-DIPN was metabolized to form several oxidized products such as the tertiary hydroxy, the primary hydroxy, and two types of dihydroxy DIPN. The formation of 2,6-DIPN metabolites in the carp hepatocyte system might occur in the following order: tertiary monohydroxyl, primary monohydroxyl, tertiary-tertiary dihydroxyl, and finally primary-tertiary dihydroxyl metabolite at the isopropyl group. (Moore-IVI)
W86-00879

EFFECTS OF SOME DIVALENT METALS ON CARDIAC AND BRANCHIAL CA2+-ATPASE IN FRESHWATER FISH SACCOBRANCHUS FOSSILIS,
Industrial Toxicology Research Centre, Lucknow (India).
S. K. Bansal, R. C. Murthy, and S. V. Chandra.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, p 373-377, June, 1985. 3 Tab, 12 Ref.

Descriptors: *Metals, *Toxicity, *Adenosine triphosphatase, *Calcium, *Saccobranchus, Enzymes, Magnesium, Mercury, Lead, Manganese, Cadmium, Fish, Calcium pump.

The heart and gill of a freshwater fish Saccobranchus fossilis have been shown to contain a Ca(2+)-activated ATPase involved in Ca(2+) transport. Enzyme showed optimal activity at 3 mM Ca(2+) and 3 mM ATP for gills and at 3 mM Ca(2+) and 1 mM ATP for heart. Mg(2+) was equally effective in stimulating enzyme activity but was not essential for hydrolysis. Maximum activity was found in heart ventricular muscles as compared to gills. Among all the metals tested Hg(2+) was the most toxic (IC50, 0.75 and 0.85 micro-M for heart and gill, respectively) followed by Pb(2+), Mn(2+), and Cd(2+). The inhibition was concentration dependent and reached almost 100% with each metal at the highest concentration. Stimulation of enzyme activity was observed at lower concentrations of Mn(2+) and Cd(2+) but not with Pb(2+) and Hg(2+). Stimulation was more pronounced with Mn(2+) than with Cd(2+) in both heart and gills. The results indicated that the inhibitory effect of these metals might be through the Ca(2+)-ATPase which is a manifestation of the calcium pump in various tissues. (Author's abstract)
W86-00880

SUBLETHAL EFFECTS OF SIMULATED PULP MILL EFFLUENTS ON THE RESPIRATION AND ENERGY METABOLISM OF RAINBOW TROUT (SALMO GAIRDNERI),
Helsinki Univ. (Finland). Dept. of Zoology.
A. Oikari, M. Nikinmaa, S. Lindgren, and B.-E. Lonn.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, p 378-384, June, 1985. 3 Tab, 19 Ref.

Descriptors: *Pulp wastes, *Trout, *Water pollution effects, *Respiration, *Metabolism, Kraft mills, Effluents, Chlorophenols, Sulfate soap, Toxicity.

Rainbow trout were exposed to 0.08 x 96-hr LC50 concentration of simulated unbleached (KME-Sa) and bleached (KME-Sa + CP) kraft pulp mill effluents. A sulfate soap preparation (Sa) with and without added chlorophenols (CP) was used as the toxicant mixture. The lipid content of white muscle increased in both test groups, and its protein content decreased in the KME-Sa-treated group. The ammonia excretion rate also decreased in both test groups. These results show that there was a shift from protein to lipid metabolism. On the other hand, apart from a slight hypoglycemia, only minor changes were observed in the carbohydrate metabolism. The overall effects on blood respiratory properties were functionally insignificant. However, the effects of kraft mill effluent with and without chlorophenols were qualitatively dissimilar in several respects. (Author's abstract)
W86-00881

DICHLORVOS INTOXICATION IN A FRESHWATER PRAWN, MACROBRACHIUM LAMARREI (H. MILNE EDWARDS),
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
Omkar, and G. S. Shukla.
Ecotoxicology and Environmental Safety, Vol. 9, No. 3, p 392-396, June, 1985. 1 Tab, 29 Ref.

Descriptors: *Prawn, *Toxicity, *Dichlorvos, Pesticide toxicity, Crustaceans, Enzyme inhibition, Physiology, Metabolism, Water pollution effects.

Dichlorvos is an extensively used organophosphorous pesticide which has been shown to be very toxic to crustaceans. The freshwater prawn Macrobrachium lamarrei was exposed to dichlorvos at 0.31 and 0.62 mg/l (40 and 80% of the 96-hr LC50) for 24, 48, 72 and 96 hr. Inhibition in acetylcholinesterase and alkaline phosphatase activities with an elevation in acid phosphatase activity were recorded in M. lamarrei after sublethal dichlorvos exposure under static conditions. It is inferred that exposure to dichlorvos creates a wide-spread disturbance in the physiology of prawns which ulti-

mately leads to the death of the organisms. (Moore-IVI)
W86-00882

INFLUENCE OF DEVELOPMENT OF THE RIVER WIDAWKA ON THE EPHEMEROPTERA FAUNA (INFLUENCE DES AMENAGEMENTS DE LA RIVIERE WIDAWKA SUR LA FAUNE DES EPHEMEROPTERES),
Lodz Univ. (Poland). Inst. of Environmental Biology.
T. Jazdzewska.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, Part 4, p 2063-68, March 1985. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Aquatic insects, *Mayflies, *Environmental effects, *Widawka, *Poland, Mining, Stream stabilization, Temperature effects, Stream flow, Linings, Species diversity, Substrates.

The discovery of lignite deposits in Central Poland led to the foundation of the Belchatow Industrial Center (BIC). The construction of a deep shaft for mine drainage began in 1973, and in 1977 the removal of earth above the deposits commenced. The development of the BIC has led to unfavorable changes in the natural environment in the area, most of which lies within the Widawka river basin. The influence of the BIC on the Ephemeroptera of the Widawka was studied in segments of the river above and below the area of influence, and in an area where the river runs through a concrete bed. Changes in the flow and thermal regime of the river were observed after 1975. There was a notable decrease in the number of species after the introduction of the concrete bed; there were 23 species before and 9 species after the change in the bed. Modification to the substrate of the river exerts an influence on the fauna comparable to that of organic pollution. (Moore-IVI)
W86-00914

PATTERNS OF MACROINVERTEBRATE DISTRIBUTION IN THE LLOBREGAT RIVER BASIN (NE SPAIN),
Barcelona Univ. (Spain). Dept. de Ecologia.
For primary bibliographic entry see Field 2H.
W86-00917

5D. Waste Treatment Processes

EFFECT OF TEMPERATURE ON OXYGEN TRANSFER RATE IN WASTEWATER TREATMENT,
Cleveland State Univ., OH. Dept. of Civil Engineering.
Y. Dong, and Y.-T. Hung.
International Journal of Environmental Studies, Vol. 24, No. 2, p 125-135, 1985. 3 Fig, 7 Tab, 1 Ref.

Descriptors: *Wastewater treatment, *Oxygen transfer rate, *Temperature effects, Aeration, Industrial wastewaters, Domestic wastes, Organic compounds.

A comparison was made of percent error between empirical temperature coefficients and theoretical temperature coefficients. The applicable temperature ranges for empirical temperature coefficients were also discussed. In computing the oxygen transfer efficiency of surface aerators for wastewater, the combined effect of oxygen deficit and wastewater viscosity needs to be considered. The lower the wastewater temperature, the lower the oxygen transfer efficiency of surface aerators for wastewater, since viscosity has a dominating effect on oxygen transfer rate in wastewater at lower temperatures. It is recommended that the temperature, which is the average maximum temperature expected in the aeration tank mixed liquors, should be used in the calculation of oxygenation capacity and in the selection of surface aerators for wastewater treatment. (Baker-IVI)
W86-00658

CONTAMINANT DEGRADATION IN WATER,
North Carolina State Univ. at Raleigh. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5F.
W86-00660

NEW CONCEPTUAL FORMULATION FOR PREDICTING FILTER PERFORMANCE,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
V. Tare, and C. Venkobachar.
Environmental Science and Technology, Vol. 19, No. 6, p 497-499, June, 1985. 3 Fig, 8 Tab.

Descriptors: *Filtration, *Head loss, *Removal efficiency, Water treatment, Wastewater treatment, Filters, Unit Bed Element, Porous media, Mathematical equations.

This paper describes the development of a new conceptual model for predicting head loss buildup and removal efficiency during filtration by packed beds based on the postulate that some retained particles can act as collectors and thereby improve the filtration efficiency. The concept of Unit Bed Element (UBE) and of the unit collector is used for the quantitative description of the various processes of interest which occur in the porous medium. The filtration efficiency is described by a set of three interdependent equations for monosized particles in suspension assuming the porosity of the bed to remain constant as filtration progresses. The first equation computes the single collector removal efficiency related to clean grain efficiency and retained particles acting as collectors. The second equation estimates the number of retained particles acting as collectors as a function of depth, time, and local particle concentration in suspension. The third equation predicts suspended particle concentration with time over the entire filter depth. The head loss buildup is predicted by modifying the classical head loss equation for clean beds incorporating change in the surface area to volume ratio of the filter grains. The model is calibrated and verified with a set of laboratory data obtained from literature under varying conditions of operating and system variables. The results show strong agreement between model predictions and experimental observations as indicated by low values of standard error of estimate associated with coefficient of correlation values approaching unity. (Author's abstract)
W86-00661

REMOVAL OF ARSENIC FROM GEOTHERMAL FLUIDS BY ADSORPTIVE BUBBLE FLOTATION WITH COLLOIDAL FERRIC HYDROXIDE,
Hawaii Inst. of Geophysics, Honolulu.
E. H. De Carlo, and D. M. Thomas.
Environmental Science and Technology, Vol. 19, No. 6, p 538-544, June, 1985. 7 Fig, 1 Tab, 30 Ref.
DOE contract DE-FG03-81ER10250M003.

Descriptors: *Arsenic compounds, *Adsorptive bubble flotation, *Geothermal fluids, Wastewater treatment, Geothermal power, Ferric hydroxide, Hawaii Geothermal Project.

A method is described for the separation of arsenic species from high ionic strength geothermal fluids produced by the Hawaii Geothermal Project well-A (HGP-A). The oxyanions of As(III) and As(V), which are present at a concentration level of 100 +/- 10 micro-g/L total arsenic, are concentrated by adsorbing colloid flotation (ACF) onto, or precipitate flotation with, colloidal ferric hydroxide, depending on the pH. The anionic surfactant sodium lauryl sulfate (SLS) and the cationic surfactant lauryl-ammonium chloride (LA) are used as collectors below and above the isoelectric point (IEP), respectively. Efficiency of recovery of the trivalent arsenic oxyanion is pH and method dependent whereas that of the pentavalent arsenic is independent of the flotation method employed. Quantitative removal of total arsenic in solution is achieved above pH 6.5 by coprecipitation with ferric hydroxide; LA is used as the collector, and the air flow rate is 17 +/- 3 mL/min. The zeta potentials of flocs are greatly affected by a variety of species in the geothermal fluids and the source of iron. (Author's abstract)
W86-00662

BINDING OF CADMIUM, COPPER, LEAD IONS BY MODIFIED CELLULO MATERIALS,
Benin Univ., Benin City (Nigeria). Dept. of C istry.
F. E. Okieimen, D. E. Ogbeifun, G. N. Nwala C. A. Kumsah.
Bulletin of Environmental Contamination Toxicology, Vol. 34, No. 6, p 866-870, June, 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Copper chloride, *Cadmium s *Lead nitrate, *Groundnut, *Adsorption, *El *Wastewater treatment, Metals, Heavy m Cellulose, Water treatment.

Groundnut (Arachis hypogaea) husk modifi complexation with ethylene-diaminetetra acid (EDTA) demonstrated enhanced capac bind Pb(NO3)2, CuCl2, and CdSO4 from aq solution, indicating a potential use for mo groundnut husks in removal of heavy meta from wastewaters. In studies with Cu(II) io was shown that the percentage of metal io sorbed initially increased with contact tim stabilized at about 20 min, regardless of conc tion (range: 200-500 ppm). The percentage removed decreased as concentration incr ranging from over 70% at 200 ppm to abou at 500 ppm. The concentration amount of me adsorbed per gram of groundnut husks, hov increased as initial concentration of meta increased. In flow-through column experi the amount of metal ions removed from so was Pb(II) > Cu(II) > or = Cd(II). For exa a Pb(NO3)2 initial concentration of 500 mg reduced to 186 mg/l by passage throug column, an initial CuCl2 of 500 mg/l was re to 202 mg/l, and an initial CdSO4 concentra 500 mg/l was reduced to 322 mg/l/. Propor ly greater reductions were obtained for low tial concentrations of all three salts. In the e rium experiments, the amount of metal io sorbed was lower when groundnuts w EDTA were used. (Rochester-IVI)
W86-00692

SIMULATED SOLUTE MOVEMENT WASTEWATER-PONDED SOIL,
Florida Univ., Gainesville. Dept. of Plant P gy.
R. S. Mansell, P. J. McKenna, and M. E. Ha
Soil Science Society of America Journal, V No. 3, p 541-546, May-June, 1985. 8 Fig,

Descriptors: *Solute transport, *Wastewat ovation, *Ponding, *Simulation, Land d Rapid infiltration, Sorption, Wastewater tre Phosphorus, Mathematical models.

A finite-difference numerical model was predict sorption and transport of P in infiltration land system for renovating wastewater. The soil was assumed to be saturated and two-dimensional steady flo assumed to occur from a 2-m wide pon charge zone toward a subsurface collectio located at a lateral distance of 3 m. The re lar area of interest was bounded underneat impermeable layer at the 1-m depth and w ed to a lateral length of 5 m. Phosphorus in the soil was assumed to occur as two c tive kinetic reactions - rapid physical ad followed by slower chemisorption. T movement and sorption of P in the soil w dicted with the model for a step-function in P concentration in the applied wastewa sults predicted by the model were used struct plots of concentration isopleths of P tion and sorbed phases in the soil. Sorptio tions removed P from the flowing solution soil directly beneath the recharge area, res a retardation of the concentration of P a in the drainage water. Simulated break curves for the concentration of a non solute in the drainage effluent compared those obtained with an approximate a

from published literature. (Author's ab-
599

SED VESSEL COMPOSTING BEGINS
E MAY COUNTY,
ay County (NJ) Municipal Utilities Au-

ary bibliographic entry see Field 5E.
'13

CTING WATER QUALITY IN THE
ST: IMPACT ON TIMBER HARVEST-
STS,
ta Univ., St. Paul. Dept. of Forest Re-

efson, and P. D. Miles.
Journal of Applied Forestry, No. 2, p 57-
1985. 1 Fig, 2 Tab, 16 Ref.

ors: *Forest management, *Water quality
*Costs, Cutting management, Water bars,
sed dips, Buffer strips, Culverts, Skid
ndings, Roads.

designed to perfect water quality from
areas have very real economic conse-
or timber harvesting. The magnitude of
acts varies with the practice in question
narket and financial conditions faced by
r harvester. Costs were evaluated for six
ctices designed to prevent degradation of
lity from 18 timber harvesting operations
dwest. The six practices are water bars,
ed dips, buffer strips, culverts, skid trail
g design, and seeding of roads and land-
revenue reductions ranged from 1.2% for
g landing and skid trail locations to
meeting buffer strip requirements. Nine
were profitable with application of all
es. Excluding the four harvesting oper-
ing less than zero net revenue using
nal practices, 14 of the sales have a posi-
eturn when culverts are added and land-
skid trails are redesigned. Thirteen sales
positive net return with the addition of
tices plus the installation of water bars.
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METAL CONCENTRATIONS IN MU-
WASTEWATER TREATMENT
LUDGE,
nd Gere Engineers, Inc., Syracuse, NY.
y bibliographic entry see Field 5B.
5

L OF SOLUBLE SUBSTRATES IN
LMS,
.) A/S, Soeborg (Denmark).
sen, and P. Harremoes.
ence and Technology, Vol. 17, No. 2/3,
5. 12 Fig, 4 Tab, 29 Ref.

s: *Fixed film reactors, *Biological
r treatment, Substrates, Biofilms, Bacte-
ification, Oxidation, Methanol, Acetic
ose, Mathematical equations, Diffusion,
xygen.

o all types of fixed film reactors are the
within the fixed film. The substrates may
to the surface of the bacterial layer in
erent ways, but inside the biofilm the
have to be transported, in soluble form,
eria where the reaction takes place, and
n products have to be transported out
eriments were performed with denitrifi-
with oxidation of methanol, acetic acid
e in a laboratory fixed film reactor to
the validity of equations for removal of
strates. A basic concept involving diffu-
tance to the bulk removal rate of soluble
n fixed films was verified. The experi-
irm the predictions of the half order
odel, taking diffusion of the substrates
rder intrinsic reaction rate of the bacte-
dominating processes in the film. The
s enable calculation of the kinetic pa-
rameters: diffusion coefficients, intrinsic reaction rates and half order rate constants for nitrate, methanol, acetic acid, glucose and oxygen within fixed films. Oxygen may be limiting for the surface removal rate of aerobic degradation of organics in fixed films due to the low solubility of oxygen in water and due to diffusional resistance to the oxygen transportation in the film. (Moore-IVI)
W86-00734

INFLUENCE OF PARTICULATE ORGANICS ON THE REMOVAL OF DISSOLVED ORGANICS IN FIXED-FILM BIOLOGICAL REACTORS,
Lund Univ. (Sweden). Dept. of Environmental Engineering/
E. Sarner, and S. Marklund.
Water Science and Technology, Vol. 17, No. 2/3, p 15-26, 1985. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Fixed film reactors, *Particulate matter, *Organic matter, *Dissolved solids, Biological wastewater treatment, Biofilms, Adsorption, Temperature, Glucose, Starch, Sludge.

Very little is known about the interaction between dissolved and particulate organics in the fixed-film biological process used for wastewater purification, although this process has been used for many decades. The mechanisms for the removal of dissolved and particulate organics differ and it has been found that a large fraction of the organics in most wastewaters exists in particulate form. In these experiments, the influence of particulate organics on the removal of glucose was studied in laboratory-scale fixed-film reactors. The particles used were starch particles and particles obtained from digested sewage sludge. The result of the experiments showed that for high glucose concentrations and high temperatures the removal of glucose was reduced when particles were adsorbed on the biofilm surface. A dramatic reduction was observed when large amounts of particles were adsorbed. This effect has also been observed in a full-scale trickling filter plant and in pilot trickling filters. At low glucose concentrations and low temperatures, however, a slight increase in glucose removal was observed when organic particles were adsorbed on the biofilm surface. (Author's abstract)
W86-00735

EFFECT OF LOAD FLUCTUATIONS ON THE EFFLUENT CONCENTRATION PRODUCED BY FIXED-FILM REACTORS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. E. Rittmann.
Water Science and Technology, Vol. 17, No. 2/3, p 45-52, 1985. 8 Tab, 16 Ref.

Descriptors: *Fixed film reactors, *Biological wastewater treatment, *Loading rate, Effluents, Kinetics, Wastewater treatment, Model studies.

Although time-varying loads to biological treatment processes are common, typical kinetic models are based on steady-state loads and conditions. This paper uses nonsteady-state kinetics to demonstrate the impact of load variations on the effluent concentration and load from fixed-bed biofilm reactors. The different responses for reactors having average loads that are high, intermediate, and low are compared. In most cases, time-varying input loading, in comparison with steady input loading, causes an increase in average effluent concentration; however, certain combinations of load variation and reactor type allow better performance than do steady-state loads. (Author's abstract)
W86-00736

EVALUATION OF TEMPERATURE EFFECTS ON TRICKLING FILTER PLANT PERFORMANCE,
Hebrew Univ., Jerusalem (Israel). School of Applied Science and Technology.
A. Adin, E. R. Baumann, and F. D. Warner.
Water Science and Technology, Vol. 17, No. 2/3, p 53-67, 1985. 9 Fig, 4 Tab, 11 Ref.

Descriptors: *Temperature effects, *Trickling filters, *Wastewater treatment, Sedimentation, Biological wastewater treatment, Oxidation, Physical properties, Statistical methods, Biochemical oxygen demand, Suspended solids.

Wastewater temperature has an effect on both sedimentation and secondary biological treatment processes. While trickling filters are mainly affected due to temperature influences on the rate at which biological oxidation occurs, the settling processes are affected mainly through the temperature influence on the physical characteristics of the wastewater. A mathematical-statistical method was developed to help evaluate the temperature effect on BOD and suspended solids residual ratio during and after a trickling filter plant treatment. Mathematical relationships were developed and brought to workable linear forms which are used for statistical examination by the F test method. The data is provided by regular measurements of wastewater quality in a full-scale treatment plant. While settling performance did not respond consistently to temperature changes, the secondary treatment and the overall plant performance provided good correlations with the correct representative temperatures. When a correlation of efficiency due to wastewater temperature has to be made, one should not automatically take the raw sewage temperature for this purpose, but instead select a temperature representative of the process. (Moore-IVI)
W86-00737

ROLE OF AN ANAEROBIC STAGE ON BIOLOGICAL PHOSPHORUS REMOVAL,
Kurita Water Industries Ltd., Yokohama (Japan). Kurita Cental Labs.
T. Fukase, M. Shibata, and Y. Miyaji.
Water Science and Technology, Vol. 17, No. 2/3, p 69-80, 1985. 7 Fig, 5 Tab, 8 Ref.

Descriptors: *Anaerobic digestion, *Phosphorus removal, *Activated sludge process, Biological wastewater treatment, Polyphosphates, Biochemical oxygen demand.

A detailed study was conducted on biological removal of phosphorus by an activated sludge process composed of an anaerobic stage followed by an aerobic stage in order to clarify the role of tha anaerobic stage of the process. Two distinctive sludges, one contained approximately 10% phosphorus, most of which existed in the form of polyphosphates, and other contained 1.9% phosphorus, were obtained by changing BOD concentration of influent and hydraulic detention time of the process. Although the polyphosphate-containing sludge released phosphorus in proportion to the absorbed BOD at anaerobic conditions, the sludge which did not contain polyphosphates also absorbed an equal amount of BOD at the identical rate without any external sources of oxygen. Both sludges accumulated identical levels of poly-beta-hydroxybutyrate within the sludges as the BOD sources were absorbed. These results suggest that the polyphosphate-containing sludges have no advantage over the sludges with no polyphosphates when they uptake BOD in the anaerobic stage. (Author's abstract)
W86-00738

INFLUENCE OF EXTENDED ANAEROBIC RETENTION TIME ON THE PERFORMANCE OF PHOREDOX NUTRIENT REMOVAL PLANTS,
National Inst. for Water Research, Pretoria (South Africa).
A. Gerber, and C. T. Winter.
Water Science and Technology, Vol. 17, No. 2/3, p 81-92, 1985. 2 Fig, 6 Tab, 7 Ref.

Descriptors: *Nitrogen removal, *Phosphorus removal, *Anaerobic retention time, Wastewater treatment, Nitrification, Denitrification, Chemical oxygen demand, Sludge settleability.

Laboratory-scale studies on the performance of three-stage Phoredox nutrient removal systems under nominal anaerobic retention times varying from 6 to 24 h are described. Particular attention is

given to the effect of these extended periods of anaerobiosis on biological phosphate release and uptake, nitrification and denitrification. Increasing the retention time in the abovementioned range had no deleterious effect on nitrification, COD removal, sludge settleability and denitrification but resulted in significantly improved phosphate removals. Up to 15 m/l phosphate (as P) could be removed from settled wastewater at nominal anaerobic retention times of 12 h or more. (Author's abstract)
W86-00739

LOCATION OF PHOSPHORUS IN ACTIVATED SLUDGE AND FUNCTION OF INTRACELLULAR POLYPHOSPHATES IN BIOLOGICAL PHOSPHORUS REMOVAL PROCESS,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
T. Mino, T. Kawakami, and T. Matsuo.
Water Science and Technology, Vol. 17, No. 2/3, p 93-106, 1985. 9 Fig, 11 Ref.

Descriptors: *Phosphorus removal, *Activated sludge process, *Polyphosphates, Biological wastewater treatment, Aerobic conditions, Anaerobic conditions, Microorganisms.

The STS method, a method for the fractionation of intracellular phosphorus, was introduced into the examination of the phosphorus location of activated sludges, and some basic aspects involved in the biological phosphorus removal process were investigated from biological points of view. Although both lowmolecular and highmolecular polyphosphates appeared in the sludges produced in the biological phosphorus removal process, the high phosphorus content of the sludges was caused mainly by the accumulation of lowmolecular polyphosphates and lowmolecular polyphosphates were principally responsible for the release and uptake of phosphorus. The turnover of phosphorus in lowmolecular and highmolecular polyphosphates was investigated by using P-32 labelled orthophosphate as a tracer. The phosphorus turnover in lowmolecular polyphosphates was not observed under both anaerobic and anerobic conditions, while the phosphorus turnover in highmolecular polyphosphates occurred under the aerobic conditions. It was indicated that lowmolecular polyphosphates function as the energy pool under the anaerobic conditions and that highmolecular polyphosphates function as the phosphorus source for the microbial growth. (Author's abstract)
W86-00740

PHOSPHORUS REMOVAL FROM WASTEWATER BY THE CRYSTALLIZATION METHOD,
Kurita Water Industries Ltd., Yokohama (Japan).
I. Joko.
Water Science and Technology, Vol. 17, No. 2/3, p 121-132, 1985. 13 Fig, 2 Tab, 12 Ref.

Descriptors: *Phosphorus removal, *Wastewater treatment, *Crystallization method, Calcium phosphate, Hydrogen ion concentration, Pilot plants.

To develop a new process for phosphorus removal the calcium phosphate crystallization method has been investigated. The metastable zone of calcium phosphate precipitates which is defined by concentrations of phosphate and calcium ions and pH was determined by batch experiments. Phosphorus in wastewaters can be constantly reduced to a sufficiently low level at the metastable reaction zone under the presence of seed crystals. The crystallization method proved to be practicable as advanced technology for phosphorus removal from wastewater through column tests and 50 cu m/day pilot plant tests over 180 days with a sewage secondary effluent. (Author's abstract)
W86-00741

PHOSPHATE REMOVAL BY CRYSTALLIZATION IN A FLUIDIZED BED,
DHV Consulting Engineers, Amersfoort (Netherlands).
J. C. van Dijk, and H. Braakensiek.
Water Science and Technology, Vol. 17, No. 2/3, p 133-142, 1985. 3 Fig, 6 Tab, 7 Ref.

Descriptors: *Phosphorus removal, *Fluidized bed reactors, *Crystallization method, Calcium phosphate, Recycling, Wastewater treatment.

Conventional methods for the removal of phosphates from wastewater produce a substantial amount of chemical sludge. A new process is described for the removal of phosphate from effluent from sewage treatment plants based on crystallization of calcium phosphate in a fluidized bed. No sludge is produced, only a small quantity of water-free pellets. The calcium phosphate pellets can be used in the phosphate industry, thus creating a simple and effective method of recycling phosphate. In 1984 a demonstration unit with a capacity of 270 cu m/d will be built. Cost calculations were prepared for a full-scale plant. (Moore-IVI)
W86-00742

BATCH ANAEROBIC METHANOGENSIS OF PHENOLIC COAL CONVERSION WASTEWATER,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
P. M. Fedorak, and S. E. Hrudey.
Water Science and Technology, Vol. 17, No. 2/3, p 143-154, 1985. 5 Fig, 3 Tab, 15 Ref.

Descriptors: *Anaerobic digestion, *Methanogenesis, *Coal conversion wastewater, Phenols, Organic acids, Inhibitors, Wastewater treatment.

Batch experiments using the Hungate serum bottle technique were used to determine the anaerobic treatability of phenolic (7600 mg/l by 4-aminoantipyrine) wastewater from an H-coal conversion pilot plant. Methane production above controls was achieved at up to 6% V/V dilution. At these levels, inhibitory components in the wastewater retard but do not stop volatile organic acid (VOA) fermentation to methane. Ether-extracted wastewater was tested at up to 50% V/V cultures receiving 200 mg/l phenol and was found not to be inhibitory, suggesting that inhibitory components in the wastewater are ether-extractable. Finally, a 'reconstituted H-coal' which contained pure phenolic constituents added to ether-extracted H-coal exhibited batch methanogenesis above controls at H-coal dilutions up to 10% V/V. These findings indicate that the ether-extractable inhibitory substances are not one of the major phenolic compounds present in the H-coal wastewater. (Author's abstract)
W86-00743

THERMOPHILIC ANAEROBIC CONTACT DIGESTION OF PALM OIL MILL EFFLUENT,
Rubber Research Inst. of Malaya, Kuala Lumpur (Malaysia).
A. Ibrahim, B. G. Yeoh, S. C. Cheah, A. N. Ma, and S. Ahmad.
Water Science and Technology, Vol. 17, No. 2/3, p 155-166, 1985. 2 Fig, 6 Tab, 11 Ref.

Descriptors: *Anaerobic contact digestion, *Palm oil mills, *Thermophilic digestion, Anaerobic digestion, Malaysia, Wastewater treatment, Scum, Malaysia.

The palm oil industry in Malaysia generates enormous quantities liquid waste with high organic load causing serious pollution problems. Anaerobic pretreatment is usually practised prior to aerobic breakdown, and most of the anaerobic digesters operate under mesophilic conditions. The inherently high temperature of the effluent suggested that the thermophilic digestion would bring about a much more effective system. Pilot plant studies indicate that the anaerobic contact digester may be used for the digestion of palm oil mill effluent. At a temperature of 45 C, the digester could be operated at a maximum organic load of about 3.11 kg BOD/cu m/day, giving a percentage reduction of around 94%. A higher loading of about 3.44 kg kg BOD/cu m/day was tolerable at the higher temperature of 50 C, but some limitations in reactor design did not favor operation at these high loading rates. One obvious modification which may require incorporation is a provision for some scum breaking mechanism at the digester su
(Moore-IVI)
W86-00744

OXIDATION OF SULFIDE AND THIO FATE AND STORAGE OF SULFUR G ULES IN THIOTHRIX FROM ACTIVA SLUDGE,
Odense Univ. (Denmark). Biological Inst.
P. H. Nielson.
Water Science and Technology, Vol. 17, No p 167-181, 1985. 3 Fig, 3 Tab, 36 Ref.

Descriptors: *Thiothrix, *Sulfides, *Thiosul *Sulfur, *Activated sludge process, Bu sludge, Sulfur bacteria, Wastewater treatment

Thiothrix from activated sludge is, in the pre of oxygen, able to oxidize sulfide and thios and store many clear sulfur granules at s concentrations less than about 1 mM and th fate concentrations of 0.1-20 mM. On this ba sulfur storage test for the identification of Th rix in activated sludge was developed. It is s that the filamentous bacteria, Type 021N (monly causing bulking in sewage plants), is al store sulfur granules and thus is a Thiothri enrichment cultures with thiosulfate ty Thiothrix rosettes and motile gonidia are o oped, and the presence of a sheath is demonst Filamental diameter varies between 0.8-2.4 m m, the youngest filaments being thinnest. Att to isolate Thiothrix have been unsuccessful Thiothrix filaments with only a few contami are able to grow on solid media with acetate only carbon and energy source, indicatin presence of heterotrophic strains. The filame organisms of 14 Danish sewage treatment are identified, Thiothrix being the most comm 8, and responsible for bulking in 4 plants. (Au abstract)
W86-00745

KINETIC STUDIES OF THE MICROBIOL CAL CONVERSION OF SULPHATE TO DROGEN SULPHIDE AND THEIR EVANCE TO SULPHIDE GENERA WITHIN SEWERS,
Monash Univ., Clayton (Australia). Dep Chemical Engineering.
G. A. Holder, G. Vaughan, and W. Drew.
Water, Science and Technology, Vol. 17, No p 183-196, 1985. 7 Fig, 2 Tab, 17 Ref.

Descriptors: *Kinetics, *Sulfur bacteria, *Se *Sulfides, Hydrogen sulfide, Mass transport, matical equations, Model studies, Wastewate

Corrosion of concrete sewers occurs as a res hydrogen sulfide formation from sulfate-cont sewage. The problem arises because ba which utilize the sulfate ion as a source of o flourish in warm anaerobic sewage. In orc design effectively form sulfide control, a re means of predicting the rate of sulfide prod is desirable. Predictive equations presently are compared, and the desirability of rep these empirical equations by a more scientif proach based on an analysis of mass transpo biochemical reaction is stressed. A theoretica ysis of mass transport and metabolism of s during laminar flow in a model sewer is desc Laboratory experimental studies consisted of ing simulated sewage through tubes containin films of mixed cultures of sulfate reducing ba The diffusional resistance in the liquid phas negligible and the biological conversion of s to sulfide followed zero order kinetics when transfer was not rate limiting. The observed s removal rates gave good agreement with A lian field data for sulfide generation in sewers value of the zero order rate constant (measu 41 C) was 30 mg/cu cm/h. The results o study can be utilized to estimate potential h gen sulfide production in sewers. (Moore-IVI
W86-00746

MIXING AND DETENTION TIME DIST TION IN ACTIVATED SLUDGE TANKS,

ver Univ. (Germany, F.R.). Inst. fuer Sied-wasserwirtschaft.
ode, and C. F. Seyfried.
r, Science and Technology, Vol. 17, No. 2/3, -208, 1985. 9 Fig, 14 Ref.

riptors: *Mixing, *Detention time, *Activated e process, Wastewater treatment, Tracers, , Plug flow, Aeration tanks, Particulate r.

manner in which wastewater is introduced he tank and the mixing characteristics of the on tank are important parameters in the acti- sludge process. Tracer test evaluation for ted sludge tank mixing is difficult due to the ation of return sludge. The tracer response for tanks in plug flow and tanks in series ach the response curves of completely mixed with increasing return sludge ratios. The sludge cycle impedes the acquisition of de- e results considerably. The return sludge produces invalid relevant concentration dis- on for the aeration tank, due to delay of the sludge in the secondary clarifyer and to le detection of tracer particles circulating in urn sludge cycle. Two methods for dealing hese difficulties are mentioned. One method to the case of tanks in parallel flow with on secondary clarification, the other applies line operation or several independent paral- s. In the field, potentially existing stagnation in aeration tanks result in accelerated dis- of a portion of the influent as compared tagnation-free tanks. This accelerated dis- is compensated for in the mean detention y the delayed discharge of those particles n the stagnation zones. Dead regions result, the lack of any liquid interchange whatso- ith the remaining tank contents, in an actual on of the mean detention time. The results field investigation of a tank with rotating emonstrate a clear difference between its response curve and that for a completely ank of equal size. (Moore-IVI)
0747

ENCE OF MACROMIXING ON OR- CARBON UPTAKE AND SOLIDS PRO- ON BY AEROBIC SUSPENDED BIO-

llier-2 Univ. (France). Lab. de Genie Chi- Applique aux Biotechnologies.
leh, T. L. Yoon, and A. Grasmick.
Science and Technology, Vol. 17, No. 2/3, 9, 1985. 9 Fig, 1 Tab, 15 Ref.

tors: *Macromixing, *Organic carbon, c digestion, *Aerobic suspended biomass, Biological wastewater treatment, Kinetics, roduction.

luence of macromixing on organic carbon by aerobic suspended biomass has been ated using two reactors operated by paral- a perfectly mixed reactor and a compart- reactor. Conversion determined on filtrat- les is identical in both of the reactors but s solids production in the low-dispersed The reaction rate established on the per- ixed reactor shows an apparent first-order luence of inlet concentration but this rela- not be used in a mass balance over the mented reactor. (Author's abstract)
748

IZATION CONTROL STRATEGY FOR ATED SLUDGE PROCESS CONTROL,
wn Univ. (South Africa). Dept. of Chemi- neering.
ld, H. O. Buhr, and G. v. R. Marais.
cience and Technology, Vol. 17, No. 2/3, 4, 1985. 5 Fig, 7 Ref.

ors: *Activated sludge process, *Process *Equalization control, Hydraulic load, Or- d, Automation, Microprocessors, Diurnal

ons in hydraulic and organic loads cause ter treatment plant operating problems, necessitating some form of process control to ensure attainment of design objectives. A comparision of in-plant control with equalization control indicates that the latter is more appropriate for the case of long sludge age nutrient removal activated sludge processes which include anaerobic, anoxic and aerobic zones. A microprocessor-based control strategy is presented for the operation of an equalization tank upstream of the process to reduce, optimally, diurnal fluctuations in both flow and organic load rates. Results from implementation on a 150 Ml/d plant with an in-line equalization tank (4,5 hour mean retention time) demonstrate the successful performance of the control strategy. (Author's abstract)
W86-00749

A-B PROCESS: A NOVEL TWO STAGE WASTEWATER TREATMENT SYSTEM,
ESMIL International B.V., Amsterdam (Netherlands).
A. I. Versprille, B. Zuurveen, and T. Stein.
Water, Science and Technology, Vol. 17, No. 2/3, p 235-246, 1985. 7 Fig, 8 Tab, 15 Ref.

Descriptors: *Wastewater treatment, *A-B process, Organic load, Hydrogen ion concentration, Toxic shocks, Two-step treatment, Sludge.

New acts on wastewater disposal demand for higher process stability and effluent quality. The A-B process, a novel two step treatment system, meets these requirements in a cost effective way. Five full-scale plants have been put in operation over the last two years. The objective of this paper is to give an outline of the features of the A-B system in the context of the results of these full-scale plants. In spite of the extreme high load, the A-stage can be operated at a higher reduction rate and is stable. Variations in the organic load and pH- and toxic shocks are leveled out and a constant, mainly soluble effluent is supplied. This implicates a low sludge production in the B-state. As a consequence higher overall reduction rates are obtained as compared to conventional processes at the same sludge load. Very low and stable final effluent concentrations are observed in all full-scale plants. Of special interest are the possibilities of upgrading existing conventional treatment facilities, at minor costs, by incorporating the A-B technology. The A-B process therefore can be considered as a very promising, cost effective alternative for both existing and new wastewater treatment plants in responding to the increasing effluent demands. (Author's abstract)
W86-00750

FLEXIBLE MODELLING OF THE ACTIVATED SLUDGE SYSTEM - THEORETICAL AND PRACTICAL ASPECTS,
Environmental Protection Service, Jerusalem (Israel).
M. S. Sheffer, M. Hiraoka, and K. Tsumura.
Water, Science and Technology, Vol 17, No. 2/3, p 247-258, 1985. 10 Fig, 10 Ref.

Descriptors: *Flexible modelling, *Activated sludge process, Computer models, Algorithms, Wastewater treatment, Model studies, Mixed liquor solids.

For the purpose of optimal modelling, a 'Flexible Modelling' method was developed. A flexible set of models consisting of hierarchical mechanistic models derived from a highly detailed structured model by mechanistic simplification was obtained. The performance of a computer program with an algorithm for parameter fitting in the time domain was evaluated by use of simulation. The program was able to estimate the models' parameters, even when using data with different degrees of inaccuracy. A computer program for model selection was developed, whereby the model was selected according to the information required. It was found that for prediction of the dynamic behavior of the MLSS, the simplest model can supply all the necessary information. For prediction of effluent substrate concentration, the differences between the models' predictions depend on the characteristics of the disturbances and on the values of the models' parameters. The selection of the proper model and updating its parameters can be done by a computer which uses the presented program for model selection and parameter fitting. (Author's abstract)
W86-00751

DETERMINATION OF KINETIC CONSTANTS OF ACTIVATED SLUDGE MICROORGANISMS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
J. S. Cech, J. Chudoba, and P. Grau.
Water, Science and Technology, Vol. 17, No. 2/3, p 259-272, 1985. 9 Fig, 5 Tab, 11 Ref.

Descriptors: *Activated sludge process, *Kinetics, *Microorganisms, Respirometry, Biological wastewater treatment, Substrate removal.

A method for measuring kinetic constants of activated sludge microorganisms by means of a simple respirometer was developed and tested by using two types of mixed culture. The method can be used for those substrates that cannot be easily determined analytically. It is much more sensitive than the methods based on the biomass growth or substrates removal. The method determines kinetic constants of mixed cultures at given loading and mean cell residence time without changing its qualitative and quantitative composition. Both the maximum substrate removal rate and the half-velocity coefficient are basically lower with the mixed cultures cultivated in a completely-mixed reactor (filamentous) than with those cultivated in a selector-type reactor (nonfilamentous). (Moore-IVI)
W86-00752

DEVELOPMENT OF POLLUTANT SPECIFIC MODELS FOR TOXIC ORGANIC COMPOUNDS IN THE ACTIVATED SLUDGE PROCESS,
Vanderbilt Univ., Nashville, TN. Dept. of Civil and Environmental Engineering.
A. T. Watkin, and W. W. Eckenfelder, Jr.
Water, Science and Technology, Vol. 17, No. 2/3, p 279-289, 1985. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Organic compounds, *Activated sludge process, *Model studies, Biological wastewater treatment, Phenol, Dichlorophenol, Dinitrophenol, Dinitrobenzene, Carbon tetrachloride, Volatilization, Biodegradation, Mathematical models.

The concept of pollutant specific models in completely mixed biological recycle reactors is developed. Pollutant specific Monod constants are developed by considering substrate utilization, cell growth, and endogenous decay rates based solely on influent and effluent specific pollutant concentrations. In this way, models are developed which predict specific pollutant removal in biological reactors. Three nonvolatile compounds are evaluated; namely, phenol, 2,4-dichlorophenol, and 2,4-dinitrophenol and their respective specific Monod constants determined. A pollutant specific model for concurrent biodegradation and volatilization is also developed. A mathematical method for evaluating the pollutant specific Monod constants independent of volatilization kinetics is derived for the volatile compounds dinitrobenzene and carbon tetrachloride. Control strategies are discussed which emphasize the rate limiting pollutant cncept. Conclusions are drawn as to the applicability and limitations of pollutant specific models. (Author's abstract)
W86-00754

KINETIC ANALYSIS OF BOD AND NITROGEN REMOVAL IN AN OXIDATION DITCH,
Kyoto Univ. (Japan). Dept. of Sanitary Engineering.
Y. Terashima, and M. Ishikawa.
Water, Science and Technology, Vol. 17, No. 2/3, p 291-302, 1985. 12 Fig, 4 Tab, 7 Ref.

Descriptors: *Nitrogen removal, *Biochemical oxygen demand, *Oxidation ditch, *Kinetics,

Model studies, Nitrification, Denitrification, Dissolved oxygen, Alkalinity, Computer models, Simulation.

The simultaneous removal of nitrogen as well as organic substances is one of the important characteristics of the oxidation ditch process. To describe this phenomena, synthetic kinetic models including the rates of BOD oxidation, nitrification, denitrification, DO and alkalinity changes, and sludge growth were proposed in this study. Rate equations for these mechanisms were mainly based on Monod type kinetics taking into account several limiting effects among these mechanisms. To develop the design procedure, these kinetic models were combined with the tank-in-series model having circulating and back flows. They were analyzed numerically for typical design and operating conditions. From these computer simulations, successful results to explain these complicated phenomena and several design and operating bases were obtained. (Author's abstract)
W86-00755

STEADY STATE MEASUREMENT OF OXYGENATION CAPACITY,
Amsterdam Public Works (Netherlands). Sewerage and Drainage Dept.
K. de Korte, and P. Smits.
Water, Science and Technology, Vol. 17, No. 2/3, p 303-311, 1985. 9 Fig, 1 Ref.

Descriptors: *Oxygenation capacity, *Steady state measurement, Activated sludge, Aeration, Oxygen saturation, Wastewater treatment.

Oxygenation capacity (OC) measurement by the non-steady state method (reaeration) in tapwater or in activated sludge is difficult and expensive. The steady state method for measuring OC using activated sludge is presented. OC measurement at steady state conditions with (endogenous) activated sludge is practicable for various aeration systems and results in values representative for the practical conditions during measurement. The alpha factor, which influences the oxygen transfer coefficient, depends on the waste characteristics and the type of aeration system. Because the waste characteristics change during treatment, the alpha factor is not constant. With increasing degree of treatment, the influence of the alpha factor decreases. The beta factor, which influence the oxygen saturation, depends on the dissolved solids. In most cases the oxygen saturation is hardly influenced and the oxygen saturation in activated sludge is practically the same as in pure water. Steady state OC measurement is easy to do, is not labor-intensive and consequently can be performed at low cost. The results are satisfactory for most purposes. (Moore-IVI)
W86-00756

REMOVAL OF IRON CYANIDE FROM GOLD MILL EFFLUENTS BY ION EXCHANGE,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
D. T. Vachon.
Water, Science and Technology, Vol. 17, No. 2/3, p 313-324, 1985. 6 Fig, 5 Tab, 8 Ref.

Descriptors: *Iron cyanide, *Gold mill wastes, *Ion exchange, Industrial wastewater, Cyanides, Iron compounds, Mine wastes, Resins, Regeneration.

Using a strongly basic anion exchanger (Rohm and Haas Amberlite IRA-958) laboratory ion exchange tests were conducted on the removal of iron cyanide from synthetic and actual gold mill effluents. Variables examined included the effects of pH, concentration and hydraulic loading of the feed on the resin exchange capacity and resin column utilization. The results showed ion exchange to be an effective method of removing iron cyanide to concentrations of less than 3 mg/L. Tests with synthetic gold mill effluents gave resin exchange capacities ranging from 13 to 34 mg CNFe/mL resin depending on the concentration of iron, copper and zinc cyanides in these solutions. When raw barren bleed was tested, an exchange capacity for the ferro/ferricyanides was determined to be about 6 to 8 mg CNFe/mL resin. For chlorinated barren bleed, a resin exchange capacity of 14 mg CNFe/mL resin was observed. A capacity of 19 mg CNFe/mL resin was achieved for tailings pond decant. Regeneration with 15% NaCl provided mixed results with recoveries ranging from 40 to 100% of the iron cyanide exchanged by the resin. Upon multiple exchange-regeneration cycles, the resin lost 25% of the exchange capacity for total cyanide during the first cycle. Subsequently, the loss in exchange capacity was approximately 1% per cycle. Pilot scale tests were considered essential prior to full scale system design. (Author's abstract)
W86-00757

TOTAL EFFLUENT TREATMENT AND RINSE WATER RECLAMATION IN A SEMICONDUCTOR DEVICE MANUFACTURING FACILITY,
C3 International, Minneapolis, MN.
P. S. Cartwright.
Water, Science and Technology, Vol. 17, No. 2/3, p 325-336, 1985. 2 Fig.

Descriptors: *Metal-finishing wastes, *Semiconductor industry, *Wastewater renovation, Water reuse, Wastewater treatment, Electroplating, Copper, Nickel, Ultrapure water, Industrial wastewater.

A manufacturer of semiconductor devices uses several electroplated coatings during the production process. After each plating bath, the devices are rinsed in ultrapure water. Three of the baths contain toxic heavy metals (copper and nickel). In order to minimize the volumetric discharge containing the metals as well as the costs of purifying large quantities of raw water, a complete reclamation and waste treatment system was installed. The system consists of the rinse water reclamation system, the make-up water system, the polishing system, and the waste treatment system. Over 90% of the rinse water is purified back to 18 megohm/cm quality of reuse, and the concentrated toxic chemicals are precipitated and disposed of as an insoluble sludge. Based on maximum rinse water flow of 72,000 gallons per day, the total operating cost is $251.41/day. (Moore-IVI)
W86-00758

DEVELOPMENT OF A NEW PROCESS FOR TREATING URANIUM MINING EFFLUENTS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
P. M. Huck, W. B. Anderson, and R. C. Andrews.
Water, Science and Technology, Vol. 17, No. 2/3, p 337-350, 1985. 3 Fig, 9 Tab, 7 Ref.

Descriptors: *Uranium mines, *Mine wastes, *Radium, *Coprecipitation, Wastewater treatment, Fluidized bed process, Barium sulfate, Radium sulfate, Radioactive wastes.

Decants from Canadian uranium mining tailings areas are treated to remove radium-226 prior to discharge into the environment. This paper describes the development of a new treatment process for these effluents. This new process differs from existing systems in that it involves the use of a fluidized bed to facilitate (Ba,Ra)SO4 coprecipitation on a granular medium of high surface area. No solids separation step is required, as the granular material is free draining. The new process has been demonstrated to provide radium-226 removal efficiencies consistently exceeding 90% in contact times of about 20 seconds. These short times are in contrast to times on the order of days for conventional pond systems or hours for mechanical systems involving stirred tank precipitation reactors. (Author's abstract)
W86-00759

DYNAMICS OF NITRIFICATION IN A BIOLOGICAL FLUIDIZED BED REACTOR,
Toledo Univ., OH. Dept. of Civil Engineering.
S. W. Hermanowicz, and J. J. Ganczarczyk.
Water, Science and Technology, Vol. 17, No. 2/3, p 351-366, 1985. 5 Fig, 3 Tab, 37 Ref.

Descriptors: *Fluidized bed process, *Nitrification, Biological wastewater treatment, Mathematical models, Simulation, Substrate removal, Microorganisms, Mass transfer, Biofilms,

Dynamics of nitrification in a biological bed reactor was investigated with numeric lations and experimentally in a small scale A mathematical model was developed de reactor dynamics, substrate removal and development. Variable microbial activity as a quantitative representation of the sta microorganisms. External and internal ma fer limitations were considered in substrate al modelling. The effects of biofilm gr reactor hydrodynamics and on substrate kinetics were incorporated into the mode experimental part, the performance of the ing fluidized bed was monitored as the concentration was varied following an square wave pattern. The observed chang effluent concentration depended not only conditions but also on the past history system. Further analysis was carried with of the developed model. The concept of microbial activity was instrumental in exp of the microbial dynamics. Predictive cap the properly calibrated model were demo (Author's abstract)
W86-00760

MODELING, OPTIMIZATION AND OF FLUIDIZED BEDS FOR BIOL DENITRIFICATION,
Technische Hogeschool Delft (Netherlan of Sanitary Engineering.
T. J. Nieuwstad.
Water, Science and Technology, Vol. 17, p 367-383, 1985. 7 Fig, 3 Tab, 27 Ref.

Descriptors: *Fluidized bed process, *De tion, *Model studies, *Optimization, Matl models, Biological wastewater treatment, Nitrites, Kinetics, Particle size.

A mathematical model for fluidized bed cation has been derived, based on the fl theory and on zero order kinetics for b nitrate reduction with nitrite as an inte product. Bed expansion, particle size, slu centration and nitrate and nitrite concentr be calculated as a function of the height in Complete optimal conditions were not fo carrier materials of various specific gra with sizes above a radius of 0.2 mm, w arbitrarily chosen as the smallest carrier However, for each size and type of carrie an optimal thickness of the biomass layer calculated for a standard type of waste constant flow rate. For the kinetic and o stants used in this study, graphs are which can be used in the design of fluid for denitrification. (Author's abstract)
W86-00761

MATHEMATICAL MODEL OF SIMU OUS ORGANIC OXIDATION, NIT TION, AND DENITRIFICATION IN ING BIOLOGICAL CONTACTORS,
Miyazaki Univ. (Japan). Dept. of Civil ing.
Y. Watanabe, S. Masuda, K. Nishidome, a Wantawin.
Water, Science and Technology, Vol. 17, p 385-397, 1985. 14 Fig, 4 Tab, 11 Ref.

Descriptors: *Mathematical models, *O *Nitrification, *Denitrification, *Rotatin cal contactors, Biological wastewater t Simulation, Organic matter, Computer mo

Simultaneous organic oxidation and ni rates in the RBC (rotating biological cont given using a mathematical equation. The was derived from a hypothesis stating tha oxygen uptake rate of the biofilm has a value at a fixed temperature, independe composition of the aerobic bacteria. Bas hypothesis, empirical equations are pro describe the profile of intrinsic organic and nitrification rates. Computer simulat simultaneous organic oxidation and ni

rried out to confirm the empirical equations. athematical model of the simultaneous nitri- and denitrification is discussed and was by computer simulation. (Author's abstract) 0762

CATION OF PREDENITRIFICATION FICATION TECHNOLOGY FOR TRACE AMINANT CONTROL,
nmental Protection Service, Burlington). Waste Water Technology Centre.
er, and S. G. Nutt.
Science and Technology, Vol. 17, No. 2/3, 8, 1985. 2 Fig, 5 Tab, 21 Ref.

tors: *Predenitrification nitrification, vater treatment, Coke plant wastewater, liquefaction wastewater, Industrial ter, Activated sludge process, Fluidized ocess, Trace compounds, Organic com-

rification nitrification (PDN) technology lied in two stage anoxic-aerobic systems coke plant wastewaters and coal liquefac- ocess condensates. Both activated sludge ogical fluidized bed modes of operation vestigated for their potential to remove , phenol, thiocyanate, cyanide and a wide trace organic contaminants. It was dem- that during nitrification of these complex ters, simultaneous removal of most of the onal and trace organic contaminants was . Specifically, of the base/neutral extracta- nic compounds, only di-n-butyl phthalate istently found in treated effluent samples r than trace levels (0.01 mg/l). It appears e organic contaminant control in complex wastewaters can be achieved by the ap- of PDN technology. (Author's abstract) 53

ED NITRITE OCCURRENCE IN BIO- L WASTEWATER TREATMENT SYS-

niv., Lafayette, IN. School of Civil Engi-
ience and Technology, Vol. 17, No. 2/3, , 1985. 6 Fig, 43 Ref. NSF grant CME-

rs: *Nitrites, *Biological wastewater Ammonium, Nitrification, Temperature arbon dioxide, Oxygen, Hydrogen ion tion, Nitrates.

nitrite plays a critical intermediary role ation, it is generally regarded as a nomi- tuent of nitrified wastewater effluents. le and full-scale nitrification systems rtedly encountered elevated nitrite con- s. Several concerns are generated by this ce, including: an increased chlorine n increased effluent nitrogenous oxygen otential nitrite toxicity, and possible ni- formation. An overview is provided of ditions which could lead to elevated currence in biological nitrification sys- seven conditions include: reduced tem- limiting O2 or CO2 presence; elevated mmonia presence; elevated solids wast- process loadings; and cryptic nitrate (Moore-IVI)

SLUDGE ANOXIC-AEROBIC SYS- R BIOLOGICAL TREATMENT OF ANT WASTEWATERS,
Ricerca sulle Acque, Rome (Italy).
, A. C. Di Pinto, R. Passino, R.
and V. Tandoi.
ence and Technology, Vol. 17, No. 2/3, 1985. 3 Fig, 6 Tab, 13 Ref.

: *Biological wastewater treatment, t wastewater, *Single sludge process, gestion, Anaerobic digestion, Phenols, , Design criteria, Costs.

A study on the biological treatment of coke plant liquid wastes, with high concentration of ammonium nitrogen and phenols, is presented. The anoxic-aerobic single sludge process is used, with the phenols as electron donors in the denitrification process; the inhibiting effect of toxic substances present in the wastewater is prevented by means of dilution. Tests were conducted in a laboratory scale plant to determine the minimum dilution ratio necessary to avoid inhibition and the parameters required for the designing of a full scale plant. Finally the basic design considerations of a wastewater treatment plant for a 1000 t/d coke plant are reported and capital and running costs are evaluated. (Author's abstract)
W86-00765

UV INACTIVATION OF PATHOGENIC AND INDICATOR MICROORGANISMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. C. H. Chang, S. F. Ossoff, D. C. Lobe, M. H. Dorfman, and C. M. Dumais.
Applied and Environmental Microbiology, Vol. 49, No. 6, p 1361-1365, June, 1985. 4 Fig, 31 Ref. EPA grant R809593010.

Descriptors: *Ultraviolet radiation, *Disinfection, *Pathogens, *Bioindicators, Bacteria, Viruses, Protozoans, Coliforms, Microorganisms, Spores, Cysts, Wastewater treatment, Water treatment.

Survival was measured as a function of the dose of germicidal UV light for the bacteria Escherichia coli, Salmonella typhi, Shigella sonnei, Streptococcus faecalis, Staphylococcus aureus, and Bacillus subtilis spores, the enteric viruses poliovirus type 1 and simian rotavirus SA11, the cysts of the protozoan Acanthamoeba castellanii, as well as for total coliforms and standard plate count microorganisms from secondary effluent. The doses of UV light necessary for a 99.9% inactivation of the cultured vegetative bacteria, total coliforms, and standard plate count microorganisms were comparable. However, the viruses, the bacterial spores, and the amoebic cysts required about 3 to 4 times, 9 times, and 15 times, respectively, the dose required for E. coli. These ratios covered a narrower relative dose range than that previously reported for chlorine disinfection of E. coli, viruses, spores, and cysts. (Author's abstract)
W86-00774

METHANOGENESIS IN AN UPFLOW ANAEROBIC SLUDGE BLANKET REACTOR AT PH 6 ON AN ACETATE-PROPIONATE MIXTURE,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
E. ten Brummeler, L. W. Hulshoff Pol, J. Dolfing, G. Lettinga, and A. J. B. Zehnder.
Applied and Environmental Microbiology, Vol. 49, No. 6, p 1472-1477, June, 1985. 9 Fig, 2 Tab, 24 Ref.

Descriptors: *Methanogenesis, *Upflow anaerobic sludge blanket process, Anaerobic digestion, Biological wastewater treatment, Methanothrix, Methanosarcina, Sludge, Hydrogen ion concentration.

High-rate anaerobic digestion can be applied in upflow anaerobic sludge blanket reactors for the treatment of various wastewaters. In upflow anaerobic sludge blanket reactors, sludge retention time is increased by a natural immobilization mechanism (viz. the formation of granular type of sludge). When this sludge is cultivated on acid-containing wastewater, the granules mainly consist of an acetoclastic methanogen resembling Methanothrix soehngenii. This organism grows either in rods or in long filaments. Attempts to cultivate a stable sludge consisting predominantly of Methanosarcina sp. on an acetate-propionate mixture as substrate by lowering the pH from 7.5 during the start-up to approximately 6 failed. After 140 days of continuous operation of the reactor a filamentous organism resembling Methanothrix soehngenii prevailed in the sludge. The specific methanogenic activity of this sludge on acetate-propionate was optimal at pH 6.6 to 6.8 and 7.0 to 7.2, respectively. (Author's abstract)
W86-00776

SEWAGE EFFLUENT PUMPS,
Texas Agricultural Experiment Station, College Station.
B. L. Carlile.
Southwest and Texas Water Works Journal, Vol. 67, No. 2, p 10 and 12, May, 1985. 1 Fig.

Descriptors: *Low pressure pipe septic systems, *Pumps, *Septic tanks, Soil water, Wastewater irrigation, Mound waste systems, Wastewater disposal.

The low pressure pipe (LPP) septic system provides the greatest promise in home waste disposal because it has demonstrated a remarkable ability to work successfully in the marginal to poor soils that predominate in today's suburban developments. The LPP is a pressure-dosed soil absorption system composed of seven basic elements: (1) septic tank, (2) pumping tank, (3) submersible sewage effluent pump and controls, (4) high-water alarm, (5) supply line and manifold, (6) distribution network, and (7) suitable soil area. Effluent is forced uniformly through holes in a network of drill-perforated polyvinyl chloride pipe, with 1/8-1/4 inch holes spaced 3 to 8 ft apart. The greatest future for sewage effluent pump systems appears to be in small community and cluster housing systems, an application in which it has already gained some acceptance from the Environmental Protection Agency and lending institutions. Other applications of sewage effluent pumps are found in mound waste systems and wastewater irrigation systems. (Rochester-IVI)
W86-00803

ANOMALIES ARISING FROM ARBITRARY MEASURES OF THE STRENGTH OF SEWAGE,
T. Stones.
Effluent and Water Treatment Journal, Vol. 25, No. 3, p 103-107, March, 1985. 8 Tab, 16 Ref.

Descriptors: *Wastewater, *Physicochemical characteristics, *Oxygen demand, Biochemical oxygen demand, Permanganate value, McGowan strength, Chemical oxygen demand, Nitrogenous oxygen demand, Total oxygen demand, Chemical characteristics, Effluent charges.

Characteristics of biochemical oxygen demand (BOD), permanganate value (PV), McGowan strength, chemical oxygen demand (COD), nitrogenous oxygen demand (NOD), and total oxygen demand (TOD) as measures of the strength of sewage were compared. Comparisons of BOD and PV of sewage with the COD have shown that the proportion of the total carbonaceous oxygen demand that they represent varies with the qualitative composition of the sewage. As a result, neither of these arbitrary parameters provides truly comparative measures of the total carbonaceous oxygen demand. They also fail to account for the NOD placed on a treatment plant or, in the case of highly nitrified effluents, the degree of nitrogenous oxidation that has been effected during treatment. Use of these arbitrary measures of sewage strength causes problems in plant management and in proper assessment of trade effluent charges. The BOD and PV measures give results that, in trade effluent charge situations, would cause the industry to be undercharged for treatment if BOD were used, and overcharged if PV were used. The ratio of BOD to COD does, however, give a rational indication of the amenability of sewage to treatment. TOD affords a valid overall criterion for realistic assessment of the capacity and performance of sewage treatment plants, and it provides a means of differentiating between the changes that have been effected in the carbonaceous and nitrogenous oxygen demands during treatment. TOD provides an equitable basis for levying trade effluent charges. (Rochester-IVI)
W86-00814

LUMPED-PARAMETER MODELING OF MULTICOMPONENT ADSORPTION IN THE TREATMENT OF COAL-CONVERSION WASTEWATER BY GAC,
Michigan Univ., Ann Arbor.

D. D. Endicott, and W. J. Weber, Jr.
Environmental Progress, Vol. 4, No. 2, p 105-111, May, 1985. 11 Fig, 8 Tab, 10 Ref.

Descriptors: *Adsorption, *Granular activated carbon, *Coal-conversion wastewater, *Lumped parameter value, *Wastewater treatment, Industrial wastewater, Model studies, Phenols, Cresol, Nitrophenol, Chlorophenol, Total organic carbon.

Granular activated carbon (GAC) adsorption of synthetic, multicomponent coal conversion wastewater was modeled as a lumped parameter using a single component version of the two resistance model (MADAM: Michigan Adsorption Design and Applications Model). The predictive ability of this system was quite good. Synthetic coal conversion wastewaters consisted of different concentrations of phenol, p-cresol, o-nitrophenol, and p-chlorophenol; total organic carbon, the lumped parameter measure, was 932 mg/l in 3 solutions, 646 mg/l in the other two. Values of the standard deviation between model prediction and independent GAC column verification ranged from 3.2 to 17%. Completely mixed batch reactor isotherm and short bed adsorber (SBA) experiments produced adequate adsorption parameters for lumped parameter modeling. The values of the film transfer coefficient obtained by the SBA technique were significantly smaller than those calculated by a correlation procedure. The values of intraparticle surface diffusion coefficient were fairly consistent with reported values of this coefficient for the primary wastewater component phenol. Verification of the model predictions with deep bed adsorber breakthrough data confirmed the validity of the modeling technique for this system. Isotherm parameters had a large influence upon the accuracy of model predictions. The categorization of wastewater solutions based on multicomponent diversity aided in the selection of optimal isotherm parameters for a given DBA prediction. The accuracy of MADAM in modeling the adsorption of synthetic coal conversion wastewater appears sufficient to warrant its use for preliminary design of GAC treatment systems for this application. (Rochester-IVI)
W86-00815

REMOVAL OF PHOSPHATE AT SEWAGE TREATMENT WORKS AND IMPLICATIONS ON PHOSPHATE LOADINGS INTO LOUGH NEAGH,
Department of Economic Development, Lisburn (Northern Ireland). Water Quality Branch.
A. V. Gray.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 2, p 137-154, April, 1985. 14 Fig, 3 Tab, 13 Ref.

Descriptors: *Phosphorus removal, *Wastewater treatment, *Lough Neagh, *Ireland, Ferrric aluminum sulfate, Phosphorus loading, Algal growth, Costs.

Installation of ferric aluminum sulfate (FAS) liquor dosing for phosphorus removal at 10 sewage treatment works (STW) around Lough Neagh (Northern Ireland) resulted in a reduction of annual phosphorus loading from the STWs from 118 tonnes to 22 tonnes, a change which is estimated to significantly reduce algal growth in the Lough within 5-6 yr. The FAS coagulant was produced by mixing sulfuric acid with ferruginous bauxite mined locally. Laboratory evaluation of the FAS coagulation method showed when good phosphorus removals were achieved, there were correspondingly small metal residuals, suggesting no potential for a metal build-up problem. In addition, biochemical oxygen demand (BOD) reductions were increased by FAS dosing. At the Bullays Hill STW, a trickling filter plant receiving variable strength sewage, an extra 31-40% BOD reduction was obtained in the primary stage due to FAS dosing, suggesting that the method might be an effective means of obtaining a better quality final effluent at less cost than extending the STW in the conventional manner. All plants were ultimately set up for FAS dosing, and successfully achieved the target level of less than 1 mg/l P in the effluent. Isolated instances of pulses of high-P waste disrupted some operations, however. The daily FAS requirement for one plant receiving 10,900 cu m/day was 2,670 l, which at the time cost 92 pounds sterling. The overall volumetric increase in sludge as a result of the FAS dosing procedure was anticipated to be about 50%. (Rochester-IVI)
W86-00834

SURVEY TIES NEEDS TO WATER QUALITY,
A. B. Nichols.
Journal of the Water Pollution Control Federation, Vol. 57, No. 5, p 355-357, May, 1985. 2 Tab.

Descriptors: *Wastewater treatment, *Costs, *Water quality control, Population dynamics, Pollution load, Water pollution.

According to the 1984 U.S. Environmental Protection Agency (EPA) Needs Survey Report to Congress, $85 billion would be required to meet the wastewater treatment needs of the 1984 population of the United States and its territories, $101.7 billion to meet eligible year 2000 needs, and $108.9 billion to meet total (unrestricted) needs for the year 2000. Areas with relatively high needs for publicly owned wastewater treatment to the year 2000 include California (6,313 million), Florida ($4,533 million), Illinois ($4,204 million), Massachusetts (4,696 million), New Jersey ($4,684 million), New York ($15,184 million), Ohio ($ 4,834 million), Pennsylvania ($4,749 million), and Texas ($4,145 million). When 1984 needs are met, an estimated 32% more people (approximately 70 million) will receive treatment services, and pollutant load will drop 34%, resulting in improved water quality in streams throughout the country. The service population is estimated to increase by 55% by the year 2000 and the aggregate effluent load is estimated to increase 9%. The increase in pollutant removal capacity at municipal facilities probably will not keep pace with increased population growth. As a result, if year 2000 needs are met, water quality in the nation overall will remain about the same as today, but if the year 2000 needs are not met, severe water quality degradation will result. State planning has not been sufficient to fully address the impact of future pollutant loads resulting from bringing treatment services to more people. (Rochester-IVI)
W86-00838

INNOVATIVE WATER MANAGEMENT PLAN REDUCES TREATMENT COSTS,
Culp/Wesner/Culp, Denver, CO.
B. R. Willey, and H. H. Benjes, Jr.
Journal of the Water Pollution Control Federation, Vol. 57, No. 5, p 378-383, May, 1985. 5 Fig, 5 Tab, 2 Ref.

Descriptors: *Wastewater treatment facilities, *Costs, Water management, Wastewater lagoons, Effluents, Ammonia, Water rights, Irrigation water, Trout streams, Water quality standards.

A four-cell lagoon system was designed and constructed to serve the town of Buffalo, Wyoming (population about 5,000). Reassessment of ammonia discharge criteria using a predictive model was the key to meeting stream criteria while resolving water rights issues and lowering charges. Discharge from the treatment plant to Clear Creek, a trout stream, occurs only from October through April of each year, with discharge into irrigation ditches during the rest of each year. Chlorination is employed only when discharging to irrigation ditches. The primary cells, which operate in parallel, are aerated to maximize treatment, prevent ice formation during winter, and minimize odors. All lagoons are lined with a bentonite-soil mixture to protect underlying groundwater. Gravity inflow to the primary cell eliminates the need for a raw wastewater pumping station, but pumping up through the polishing cells is required to conform to site topography. Implementation of this water management plan resulted in a present-worth saving of $4 million compared to an oxidation ditch system, the only acceptable conventional alternative in Wyoming. (Rochester-IVI)
W86-00841

USE OF A SWIRL CONCENTRATO COMBINED SEWER OVERFLOW M MENT,
Crawford, Murphy and Tilly, Inc., Spring
G. Heinking, and N. Wilcoxon.
Journal of the Water Pollution Control Fe Vol. 57, No. 5, p 398-402, May, 1985. 3 Fi 4 Ref.

Descriptors: *Combined sewer overflow concentrators, Wastewater treatment Suspended solids, Biochemical oxygen Costs, Decatur, Illinois, Sangamon River.

Construction of combined sewer overflo facilities that include a storage tank and s centrator appears to be the most cost solution to the CSO problem in Decatur Wide variations in biochemical oxygen and total suspended solids levels are to be from this system, however. Decatur is more than 90,000 population that occasio charges CSO into the Sangamon Rive during summer months is nearly dry. To problem various alternatives were consid a storage facility for 'first-flush' flow, pl concentrator to separate solids, was chos most cost-effective solution and was app the Illinois Environmental Protection Age swirl concentrator induces a swirl action for solids separation, and is able to han higher flow rates for a given surface area volume than conventional settling tanks. T the size of the CSO facilities, an optimizat was conducted to ensure that intercepti capacities were used effectively. The d Decatur required five CSO plants. The McKinley Ave., analyzed here in detail, mated to cost $1,273,800 in 1981; a plain type CSO control facility was estimate same time to cost $2,273,700. Estimate operational costs for the two types of were estimated at $156,540 and $231,80 tively. (Rochester-IVI)
W86-00844

EFFECT OF AERATION, CADMIUM C TRATION, AND SOLIDS CONTENT O EXTRACTION OF CADMIUM FROM NICIPAL WASTEWATER SLUDGE,
Ohio State Univ., Columbus.
T. J. Logan, and R. E. Feltz.
Journal of the Water Pollution Control Fe Vol. 57, No. 5, p 406-412, May, 1985. 6 F 13 Ref.

Descriptors: *Aeration, *Acid extraction, um, *Sludge, Zinc, Nickel, Metals, W treatment.

Large amounts of Cd, Zn, and Ni, th elements of concern in land applic wastewater sludges, can be removed fro bically-digested wastewater sludges with aeration. Sludge from Kent, Ohio, was u experiments because of its relatively high tent (> 1,000 mg/kg); otherwise the sl typical of sludges in this part of the U tended aeration (up to 14 days) necessar dize inorganic and organic forms of Cd vert the metal to acid-extractable forms. during the acid-extraction step was nec maintain Cd in an acid-extractable form nated the need for additional extensive prior to acid addition. Acid-extraction at 18 hr removed an average of 76% of th acid extraction was positively correlated content in the original sludge and negativ lated with sludge solids content. In addit than 70% of the Zn, Ni, Ca, and Mn w extractable, and more than 25% of the C K, 15% of the Fe, and less than 5% of th P, and Al were removed by the aer extraction procedure. (Rochester-IVI)
W86-00846

STRUCTURED MODELING OF THE OBIC DIGESTION OF BIOMASS P LATES,
Eidgenoessische Anstalt fuer Wasserve

erreinigung und Gewaesserschultz, Due- (Switzerland).
yers.
nology and Bioengineering, Vol. 27, No. 8-649, May, 1985. 11 Fig, 3 Tab, 26 Ref, 1

tors: *Structured modelling, *Anaerobic n, *Mathematical models, *Biomass, Model Biodegradation, Biological treatment, Di- Sludge digestion, Chemical reactions.

ic digestion of biological organic particu- methane was described by a structured atical model based on multiple-reaction metry, conventional material balances, and ase equilibrium chemistry. A general stoi- ic treatment for any set of multiple biolog- tions was derived based on a unit mass of equivalents of the reactions limiting sub- he resultant model was calibrated to exist- ratory studies of mesophilic (35 C) acid d thermophilic (50-60 C) anaerobic diges- vaste-activated sludge. The model agrees n two existing experimental studies of an- digestion of biomass particulates. Hypo- computer simulations illustrated possible es of the anaerobic process under various scenarios. Digester pH dynamics are a interaction of liquid phase chemistry, gas and biological reaction. In this respect a d model is capable of accounting for the ntermediates that exert direct influence on brium while an unstructured model is not. VI)
8

ICAL TREATMENT OF LANDFILL TES,
The State Univ., Piscataway, NJ. Dept. al and Biochemical Engineering.
kataramani, R. C. Ahlert, and P. Corbo.
ical Reviews in Environmental Control, No. 4, p 333-376. 15 Fig, 12 Tab, 144 Ref.

rs: *Biological treatment, *Wastewater *Landfills, *Leachates, Water analysis, tment, Environmental impact, Activated cess, Anaerobic digestion.

stics of sanitary and industrial landfill are described, and problems of their cor- cterization are reviewed. Microbial deg- f anthropogenic and recalcitrant com- cluding aromatic compounds, is also re- nd aerobic biostabilization, anaerobic ation, and physical/chemical treatment landfill leachate are described. Biologi- ent of hazardous wastewater and indus- ll leachates is discussed, and case studies rate, respiration, fate of organic carbon, microbial responses, and of in situ and degradation of industrial landfill lea- described. Biological processes are gen- y cost effective; they have been em- cessfully at full scale to a wide variety l wastes. Environmental impacts associ- biological processes are usually limited. treatment methods should be considered sposal site leachate invariably contains nts of oxygen-demanding material. The ludge process, or a modification of it, have the greatest potential for applica- dustrial leachate treatment. It can be to a great extent, and lends itself to the nt of an acclimated culture. Anaerobic because of minimal sludge production nergy efficiency, merits consideration in tions. Studies with sanitary landfill eatment indicate that biological meth- s activated sludge, anaerobic filtration, oons, and combined treatment, are ap- treating such leachate from new dump cal/chemical treatment methods, such on on activated carbon, chemical pre- hemical oxidation, and reverse osmosis, plied to biologically stabilized leachate. IVI)

AL REMOVAL OF PHOSPHORUS STEWATER,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
E. Arvin.
CRC Critical Reviews in Environmental Control, Vol. 15, No. 1, p 25-64. 13 Fig, 15 Tab, 102 Ref.

Descriptors: *Biological treatment, *Phosphorus removal, *Wastewater treatment, Water treatment, Nitrates, Anaerobic digestion, Sludge digestion.

Principles of the main treatment processes for removal of P from wastewater, the mechanism of biological P removal, chemical phosphate precipitation in biological P-removal systems, characterization of P fractions in sludge, factors in design of mainstream and sidestream treatment plants, and operational problems of these plants are reviewed. Sidestream processes are able to reduce P to a level of about 1 mg of P per liter under optimal conditions; mainstream processes, under optimal conditions, can reduce P to about 2 mg/l, which, with a small dosage of iron or aluminum salt, can be further reduced to 1 mg/l. Both sidestream and mainstream processes may require effluent filtration if the effluent P concentration must comply with stringent limits. This is due to the relatively high P content in the sludge, about 4% of P in sidestream process and 3.5-6% in mainstream processes. The extent of biological P removal from wastewater increases with increasing concentrations of soluble, readily biodegradable organics in the sewage. Nitrate and oxygen in the influent to the anaerobic reactor decrease biological P removal through oxidation of the soluble, readily biodegradable organic matter. The reactor design in biological P-removal plants is normally based on simple criteria like (aerobic) sludge age and detention times. Future design will most likely be based on process models that take into consideration the specific composition of the wastewater. New models emphasize the role of poly-P-accumulating bacteria. (Rochester-IVI)
W86-00857

DESTROYING PYROGENS IN WATER,
Electricity Council Research Centre, Capenhurst (England).
For primary bibliographic entry see Field 5F.
W86-00870

ACTIVATED BIOFILTER PROCESS FOR WASTEWATER TREATMENT,
Regina Univ. (Saskatchewan). Faculty of Engineering.
T. Viraraghavan, R. C. Landine, E. L. Winchester, and G. P. Wasson.
Effluent and Water Treatment Journal, Vol. 25, No. 4, p 129-134, April, 1985. 1 Fig, 6 Tab, 15 Ref.

Descriptors: *Wastewater treatment, *Activated biofilters, *Trickling filters, *Activated sludge process, *Biofilters, Filters, Water treatment, Cold regions, Costs, Economic aspects, Secondary wastewater treatment.

The activated biofilter (ABF) process is a hybrid of attached (trickling filter) and suspended (activated sludge) growth systems. For most domestic wastes the biocell is typically designed at a biochemical oxygen demand (BOD) loading of 3.2 kg/cu m per day. The settleability of the mixed liquor obtained from the biocell tower is quite good, even under severe shock loading. Numerous pilot studies have been conducted by the manufacturer and a case study was conducted by the US Environmental Protection Agenvcy at Helena, Montana. ABF was evaluated along with other processes for employment at Millidgeville, Saint John, New Brunswick, Canada, where a capacity of 6,820 cu m/day was anticipated based on service to a population of 12,000. Total present value costs for the competing systems were as follows: modified activated sludge process, $6,647,000; ABF, $6,023,000; rotating biological contactor system, $5,990,000; and deep shaft process, $7,431,000 (base design) or $7,625,000 (optimal design). Based on the economic criteria, plus energy, site, operational, and other considerations, ABF was recommended for secondary treatment at Millidgeville. The ABF system confers operational stability inherent in a trickling-filter system. Employment of short-term aeration as part of the process improves reliability. Heat loss across the system is minimal, an advantage in cold-climate operation. (Rochester-IVI)
W86-00871

PERFORMANCE OF AN UPFLOW ANAEROBIC REACTOR COMBINING A SLUDGE BLANKET AND A FILTER TREATING SUGAR WASTE,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
S. R. Guiot, and L. van den Berg.
Biotechnology and Bioengineering, Vol. 27, No. 6, p 800-806, June, 1985. 12 Fig, 4 Tab, 11 Ref.

Descriptors: *Upflow blanket filters, *Anaerobic digestion, *Biomass, Upflow reactors, Wastewater treatment, Biological wastewater treatment, Industrial wastewater, Food processing industry, Sugars.

The loading capacities of an anaerobic wastewater treatment system are essentially dictated by the amount of active biomass that can be retained in the reactor, provided a sufficient contact between active biomass and waste organic can be assured. A new hybrid reactor, the upflow blanket filter (UBF), combines an open volume in the bottom two-thirds of the reactor for a sludge blanket and submerged plastic rings in the upper one-third of the reactor volume. This UBF reactor was operated at 27 C at loading rates varying from 5 to 51 g COD/L d with soluble sugar wastewater (2500 mg COD/L). Maximum removal rates of 34 g COD/L d and CH4 production rates of 7 vol/vol d were obtained. The biomass activity was about 1.2 g COD/g volatile suspended solids per day. Conversion (based on effluent soluble COD) was over 93% with loading rates up to 26 g COD/L d. At higher loading rates conversion decreased rapidly. The packing was very efficient in retaining biomass. The filter at the top of the UBF reactor has two advantages: space occupied by packing is not lost space for active biomass; and exploiting the floating capacity of the plastic rings is an inexpensive method to enhance biomass accumulation. The system should be cheaper than an anaerobic filter (less packing) and more likely to avoid the problems of channeling and plugging usually occurring in the bottom part of an anaerobic filter. (Moore-IVI)
W86-00889

ANAEROBIC PRETREATMENT REDUCES MILL COSTS, IMPROVES EFFLUENT QUALITY,
Buhrmann-Tetterode N.V., Roermond (Netherlands). Wastewater Dept.
L. H. A. Habets, and J. H. Knelissen.
Pulp and Paper, Vol. 59, No. 4, p 66-69, April, 1985. 2 Fig, 2 Tab, 2 Ref.

Descriptors: *Wastewater treatment, *Pulp and paper industry, *Industrial wastewater, *Anaerobic digestion, Biogas, Costs, Water treatment.

The Upflow Anaerobic Sludge Blanket (UASB) reactor has proven to be efficient and cost effective with paper mill waste of high organic content in several different installations in the Netherlands. Pilot studies of the UASB process were conducted at various different scales, and full-scale reactors are now operating at Oude Pekala (2,472 cu ft volume), Roermond (35,300 cu ft volume), and Celtona (24,700 cu ft volume). The UASB process will function with either granular or non-granular sludge; granular sludge permits higher loadings without loss of sludge in the effluent. At the Roermond plant, where the USAB reactor pretreats wastewater to reduce the loading of an activated sludge (aerobic) plant, a daily loading of 0.99 lb chemical oxygen demand (COD)/cu ft/day has been achieved without problems. COD removal has stabilized at 75% or better, and biochemical oxygen demand (BOD) removal is almost 90%. The reactor also produces 4,590 cu ft/hr of biogas containing 1-3% H2S, which is used to generate steam used in paper production. Each ton of COD removal yields 4.7 tons of 150 psi steam; excess

biogas is flared. Each pound of COD converted yields 0.1 lb of new granular sludge, which can be used to start up new USAB reactors. After more than a year of operation, the Roermond anaerobic treatment plant has proven to be more cost-effective than aerobic digestion, mainly because the quantity of energy in the biogas produced exceeds the energy consumed to power the process. (Rochester-IVI)
W86-00890

ION EXCHANGE POTENTIALLY EFFECTIVE IN REDUCING EFFLUENT FROM BLEACH PLANT,
Jordan (Edward C.) Co., Inc., Portland, ME.
J. H. Fitch, Jr.
Pulp and Paper, Vol. 59, No. 4, p 132-135, April, 1985. 1 Fig, 3 Tab.

Descriptors: *Ion exchange, *Bleaching wastes, *Industrial wastewater, *Pulp and paper industry, *Wastewater treatment, Resins, Zinc, Copper, Cadmium, Nickel, Metals.

Batch and pilot scale ion exchange resin treatment plants at the bleach plant at Billerud Uddeholm (Skoghall, Sweden) effectively remove color, chemical oxygen demand, chlorinated phenols, chlorinated guaiacols, and complexed metals. The treatment plants, which use a special resin supplied by Diamond Shamrock Corporation, do not remove resin, fatty acids, and phthalates. Inorganic chloride was removed initially, but the removal rate declined after the cycle started. Zinc and copper are removed through complexation and chelation. Cadmium and nickel appear to be removed effectively in the second column but are virtually untouched in the first. Chlorinated phenols and guaicols are removed more efficiently toward the end of the treatment cycle, probably because of loss of ionic character at low pH and the subsequent interaction with compounds previously removed. Extended contact time yielded no benefits; effective removal was lost rapidly, and a considerable number of pollutants passed through the columns. Although the startup period was long and troublesome, a full-scale treatment plant has been operating for almost 4 yr with high availability and without any real problems. The resin life (estimated at 6 mo) is shorter than it should be, which has increased operating costs of the plant because chemical costs increase as the resin ages. (Rochester-IVI)
W86-00892

ANAEROBIC WASTEWATER TREATMENT SYSTEM OPERATES AT VERY LOW COST,
Tampella Oy A.B., Tampere (Finland).
S. Rekunen.
Pulp and Paper, Vol. 59, No. 5, p 122-125, May 1985. 3 Fig, 3 Tab, 3 Ref.

Descriptors: *Pulp and paper industry, *Anaerobic digestion, *Industrial wastewater, Methane, Biogas, Operating costs, Costs, Activated sludge process.

The first stage of a methane-producing anaerobic reactor treatment system has begun operating at the Tampella paper mill at Anjala, Finland. This plant treats one third of the mill's total wastewater using reactors of 106,000 cu ft total volume; wastewater from the debarking plant, paper machines, and groundwood production is treated. The second stage of the plant will accomodate the rest of the total of 31 tons/day of biochemical oxygen demand (7-day) and 22 tons/day of suspended solids from the mill to achieve the regulatory goals of 6.6 tpd BOD and 8.8 tpd suspended solids. The process used was developed in the laboratory and in pilot studies conducted at the Anjala plant; it is named the TAMAN process. From the preclarifier, wastewater goes to the acid fermentation facility where micoorganisms break down organic matter to low-molecular-weight acids. In the acid stage, the homogenized wastewater is conducted to the methane stage, where bacteria break down the organic acids to methane and carbon dioxide. Some 4.8 cu ft of biogas is formed per pound of BOD reduction; it contains about 70% methane by volume. The pH of the wastewater is adjusted with Ca(OH)2 and nutrients such as urea and phosphoric acids can be added, if necessary. Sludge is collected in a separate tank from which it is conducted to a mechanical sludge processor. Sludge then can be burned in a fluidized bed boiler. Biogas is burned in a boiler or flared. For the Anjala site, the TAMAN process had construction costs similar to the activated sludge process, but the TAMAN process operating costs were only 10% of those for the same treatment capacity of activated sludge. In addition, the fuel value of the biogas is nearly $145,000 (US) per year. (Rochester-IVI)
W86-00893

5E. Ultimate Disposal Of Wastes

DISTRIBUTION OF ALUMINUM IN THE TISSUES OF THREE FISH SPECIES,
Northwestern State Univ. of Louisiana, Natchitoches. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W86-00621

SIMULATED SOLUTE MOVEMENT IN WASTEWATER-PONDED SOIL,
Florida Univ., Gainesville. Dept. of Plant Pathology.
For primary bibliographic entry see Field 5D.
W86-00699

ENCLOSED VESSEL COMPOSTING BEGINS AT CAPE MAY COUNTY,
Cape May County (NJ) Municipal Utilities Authority.
W. W. Cathcart.
BioCycle, Vol. 26, No. 4, p 24-27, May-June, 1985. 5 Fig, 3 Tab.

Descriptors: *Composting, *Cape May County, *New Jersey, *Enclosed vessel composting, Sludge utilization, Costs, Wastewater treatment.

The composting system for treatment of domestic sewage sludge in Cape May County, New Jersey is described. The ABV/Purac system of in/vessel composting can be described as a vertical plug flow process. The composting vessel is fed from above by a spreader conveyer with material to be composted, and the composted material is discharged from the bottom by a power screw conveyor. Air is supplied at the bottom of the reactor and exhausted at the top. A General Electric Series Six programmable control handles the process control elements of the system. Temperature, carbon dioxide, status of the conveying system, status of the aeration system, weight of the input material, weight of the transferred material, weight of the output compost, and various warning alarms are continuously monitored. The facility includes a sludge container building, amendment storage building, operations building, maintenance building, BIO reactor, blower room, CURE reactor, and compost storage building. The development and construction costs were $9.1 million (US) and annual operating costs are $575,000. Dewatered municipal sludge of minimum 20% total sludge solids and sludge cake density of 50-60 pounds/cu ft is the input; output is a medium coarse to fine, friable compost of 10 mm maximum organic particle size and 60% maximum moisture. Volatile solids are reduced a minimum of 40% by the facility, which processes 12.1 tons per day in summer (tourist season) and 2.2 tons/day (off-season) when operating continuously. It is anticipated that some operating costs will be offset by revenues generated from sale of finished compost and by user fees charged for disposal of sludge. (Rochester-IVI)
W86-00713

LAND APPLICATION SYSTEMS FOR MUNICIPAL SLUDGE,
Nolte (George S.) and Associates, Sacramento, CA.
R. W. Crites.
BioCycle, Vol. 26, No. 4, p 32-34, May-June, 1984. 5 Tab, 11 Ref.

Descriptors: *Land application, *Sludge *Fertilizers, Cadmium, Nitrogen, Metal ents, Agriculture.

For all sizes of municipal treatment plan 25% of the sludge produced is land appl vances in design techniques over the pa allow the benefits of land application to be with minimal adverse impact. Examples o pal systems in the USA with different agr end uses for sludge are Modesto, Califo city parks, landfills and farmland), Mante fornia (for corn and ryegrass), Seattle, Wa (on forest land), and Salem, Oregon (fields ing grains, grasses and silage corn, and C tree farms). The design approach for land tion is based on the utilization of sluc replacement for commercial fertilizer. Th application is usually based on either the or phosphorus needs of a particular cr loading rate for cadmium addition is then against the nutrient-based loading rate, lower of the two rates is used for de calculating the nitrogen available to pl count must be taken of the relatively low ity of the organic nitrogen in sludge. C cadmium and nitrogen loading rates ha compared, and the lower of the two ch land area required to dispose of the s calculated by the formula: F = W/S, wh field area, in acres, W = sludge quantity, yr, and S = the sludge loading rate, in t Applying sludge to land provides consider savings compared to incineration or la (Rochester-IVI)
W86-00714

SLUDGE MANAGEMENT: A RES UPDATE,
Weston (Roy F.), Inc., West Chester, PA.
Y. Hasit.
Biocycle, Vol. 26, No. 4, p 44-47, May-Ju 80 Ref.

Descriptors: *Sludge, *Literature revi search priorities, Polychlorinated biphen achlorocylohexane, Dieldrin, Heavy meta sites, Stabilization, Composting, Sludge ut

A review of 1984 literature on sludge cha tics, solids concentration and conditioning zation and inactivation, incineration, and disposal and utilization shows that mos research has focused mainly on concerns servations related to ultimate disposal of with few fundamental studies published c properties, behavior and unit operations. P rinated biphenyls, gamma-hexachlorocycl dieldrin, heavy metals, parasitic helminth and some mutagenic compounds have bee ed from sludges. Sludge physical characte importance to system design were exami few studies; centrifuges, filter presses, be and conditioning with polymers were an topics studied. Stabilization and inactivati ies examined disinfection, pasteurization, bilization, composting techniques, vermi tion, and the occupational and public h pects of composting. Operational prob sludge incineration in Britain were attri variations in sludge quantity and quality wear and tear due to inefficient grit remo equipment failures; in a Tennessee study mentation of a fuel-efficient operating m duced annual fuel consumption by more th Land application of sludge has been studie ly from the points of view of heavy metal rates, effects of sludge on plant and animal fate of organic pollutants and metals, accu of metals, and mined land reclamation forms of sludge utilization studied were pr of oil, fertilizer, energy, and bricks. (Ro IVI)
W86-00715

CONTROL OF METAL APPLICATION FROM SEWAGE SLUDGE UTILIZAT AGRICULTURE,
Anglian Water Authority, Huntingdon (E Directorate of Scientific Services.

mary bibliographic entry see Field 5G.
854

RY/SECONDARY SLUDGE RECY-
INTO VALUABLE AGRICULTURAL
IZER,
leman.
l Paper, Vol. 59, No. 4, p 130-131, April,
Tab.

ors: *Sludge disposal, *Fertilizer, *Land
*Wisconsin, Agriculture, Vegetables, Ni-
Metals, Heavy metals, Cadmium, Zinc,
rus, Potassium, Costs.

ated Papers, of Wisconsin Rapids, Wis-
perates a program in which sludge from
any's Water Quality Center is distributed
farmers for use on sandy, irrigated soils
variety of vegetable crops (eg, green
tatoes, sweet corn, and beets) are grown.
r mill yields about 270 wet tons/day of
ven days a week; at present 2,000-3,000
receiving sludge as a soil amendment.
cation rate is 40-70 wet tons/acre, which
into a nitrogen requirement of 100-200
he nitrogen content of the sludge is 1.8-
dry solids basis; phosphorus as P (7.4 lb/
nd potassium as K (3.6 lb/dry ton) in the
ow, but local soils are generally high in
nents in this part of Wisconsin. The
tribution program also includes monitor-
receiving soils for nitrogen and solids,
eavy metals, and priority pollutants, and
local wells. Plants are tested for heavy
food quality. In spite of the costs associ-
hauling the sludge, spreading it, and
the effects, the program appears cost-
hen compared to landfilling and its as-
ting problems and construction costs.
eceive fertilizer valued far above the
r acre cost charged by Consolidated
ts sludge. The program was introduced
and the general public through a series
eetings and agricultural show presenta-
hester-IVI)

er Treatment and
ty Alteration

F SULFITE DECHLORINATION ON
UMULATION OF WATERBORNE
RAINBOW TROUT (SALMO GAIRD-

tre for Inland Waters, Burlington (On-

bibliographic entry see Field 5A.

NANT DEGRADATION IN WATER,
lina State Univ. at Raleigh. Dept. of
gineering.

tal Science and Technology, Vol. 19,
484, June, 1985. 6 Fig, 1 Tab, 32 Ref.

*Photocatalysis, *Water treatment,
, Drinking water, Organic com-
otodegradation, Photochemical reac-
enated hydrocarbons, Trichloroethy-
roethylene.

s photocatalysis was examined as a
for water purification. A slurry of 0.1
powder in water was continuously
through a reactor, a temperature-con-
and a vessel that held chloride (or
and reference electrodes for monitor-
ess of the reaction. The sample was
ugh the septum of an orifice of the
ystem was used to study the degrada-
roethanes, chloroethylenes and bro-
chlorobenzene, and chloroacetic
te aqueous solutions. The common
inants, trichloroethylene and perch-
appear to be the strongest candidates
n by a potential photocatalytic proc-
I)

W86-00660

NEW CONCEPTUAL FORMULATION FOR PREDICTING FILTER PERFORMANCE,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-00661

REMOVAL OF ARSENIC FROM GEOTHERMAL FLUIDS BY ADSORPTIVE BUBBLE FLOTATION WITH COLLOIDAL FERRIC HYDROXIDE,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 5D.
W86-00662

DRINKING-WATER AND SANITATION PROJECTS: CRITERIA FOR RESOURCE ALLOCATION,
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
R. C. Ballance, and R. A. Gunn.
WHO Chronicle, Vol. 38, No. 6, p 243-248, 1984. 2 Fig.

Descriptors: *Public health, *Developing countries, *Sanitation, *Drinking water, Water supply, Water quality, Bacteria, Protozoa, Viruses.

Most of the diseases associated with inadequate water supplies and sanitation in developing countries are caused by bacteria, protozoa, viruses or worms. The contamination of water by chemicals is a less common factor. The prevention of any infectious disease requires the transmission cycle to be interrupted. Water and sanitation related diseases may have either complex or alternative transmission cycles. In complex transmission cycles, a period of development occurs in one or two specific intermediate hosts before the pathogen becomes infective to humans. Health considerations in project appraisal which are considered include community heath status, existing water supply, proposed water supply, existing sanitation, proposed sanitation, community health programs and staff, community perception of needs, community population characteristics, community education facilities, project communication support, media for health education in the community, community organization and resources, community development projects, and a national support system. (Baker-IVI)
W86-00669

MUTAGENICITY ASSESSMENT OF DIFFERENT DRINKING WATER SUPPLIES BEFORE AND AFTER TREATMENTS,
Perugia Univ. (Italy). Cattedra di Igiene.
For primary bibliographic entry see Field 5A.
W86-00690

FACTORS INFLUENCING THE HIGH CONTENT OF BROMINATED TRIHALOMETHANES IN BARCELONA'S WATER SUPPLY (SPAIN),
Sociedad General de Aguas de Barcelona (Spain).
For primary bibliographic entry see Field 5B.
W86-00727

POTENTIAL USE OF ENZYMES FOR REMOVAL OF AROMATIC COMPOUNDS FROM WATER,
S. W. Maloney, J. Manem, J. Mallevialle, and F. Fiessinger.
Water, Science and Technology, Vol. 17, No. 2/3, p 273-278, 1985. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Water treatment, *Enzymes, *Aromatic compounds, Phenols, Chlorinated phenols, Peroxidase-peroxide system, Monochlorophenol, Dichlorophenol, Pentachlorophenol.

The removal of aromatic compounds by the peroxidase - hydrogen peroxide system was studied at low levels which might be encountered in surface waters which receive some industrial discharge. Three compounds, mono-, di-, and pentachlorophenol, are used as model aromatic compounds. The treatment process is characterized both in terms of specific compound removal and removal of its reaction products. The enzyme system is effective in eliminating chlorinated phenols at low levels from drinking water supplies, but does not remove their products from the water. Further work is necessary to determine if these by-products present a potential risk for the human health and if they are removed in other unit processes. The enzymatic procedure may offer an alternative to the standard treatments, for example for sporadic taste and odor problems associated with chlorinated phenols. (Moore-IVI)
W86-00753

UV INACTIVATION OF PATHOGENIC AND INDICATOR MICROORGANISMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5D.
W86-00774

ELIMINATION OF VIRUSES AND INDICATOR BACTERIA AT EACH STEP OF TREATMENT DURING PREPARATION OF DRINKING WATER AT SEVEN WATER TREATMENT PLANTS,
Institut Armand-Frappier, Laval (Quebec). Centre de Recherche en Virologie.
P. Payment, M. Trudel, and R. Plante.
Applied and Environmental Microbiology, Vol. 49, No. 6, p 1418-1428, June, 1985. 6 Fig, 11 Tab, 25 Ref.

Descriptors: *Drinking water, *Water treatment, *Viruses, *Bacteria, Bioindicators, Disinfection, Enteroviruses, Raw water, Coliform, Chlorination, Sedimentation, Filtration, Ozonation.

Seven drinking water treatment plants were sampled twice a month for 12 months to evaluate the removal of indicator bacteria and cytopathogenic enteric viruses. Samples were obtained at each level of treatment: raw water, postchlorination, postsedimentation, postfiltration, postozonation, and finished (tap) water. Raw water quality was usually poor, with total coliform counts exceeding 105 to 106 CFU/liter and the average virus count in raw water of 3.3 most probable number of cytopathogenic units (MPNCU)/liter; several samples contained more than 100 MPNCU/liter. All plants distributed finished water that was essentially free of indicator bacteria as judged by analysis of 1 liter for total coliforms, fecal coliforms, fecal streptococci, coagulase-positive staphylococci, and Pseudomonas aeruginosa. The total plate counts at 20 and 35 C were also evaluated as a measure of the total microbial population and were usually very low. Viruses were detected in 7% (11 of 155) of the finished water samples (1,000 liters) at an average density of 0.0006 MPNCU/liter the highest virus density measured being 0.02 MPNCU/liter. The average cumulative virus reduction was 95.15% after sedimentation and 99.97% after filtration and did not significantly decrease after ozonation or final chlorination. The viruses isolated from treated waters were all enteroviruses: poliovirus types 1, 2, and 3, coxsackievirus types B3, B4, and B5 echovirus type 7, and untyped picornaviruses. (Author's abstract)
W86-00775

ASSESSMENT OF WATER UTILITY INFORMATION SYSTEMS AND THEIR USE OF COMPUTERS,
Cincinnati Univ., OH. Dept. of Mechanical and Industrial Engineering.
R. L. Shell, and N. A. Damachi.
Water Resources Bulletin, Vol. 21, No. 2, p 323-330, April, 1985. 1 Fig, 9 Tab, 9 Ref.

Descriptors: *Utilities, *Water conveyance, *Water treatment, *Computers, Ohio, Indiana, Kentucky, Recordkeeping, Maintenance, Inspection, Water storage, Water loss, Water metering.

A direct mail survey of all water utilities serving populations of 2,000 or more in the tri-state area - Ohio, Indiana, and Kentucky was conducted, and the following were determined: utility profile information, e.g., public/private ownership, age, number of accounts, etc.; an assessment of the degree of computerization presently in place to perform various functions; and an assessment of any plans that the utilities may have for future computerization. To analyze the data, an index of computerization was defined as the number of departments or major areas of each utility that presently have some computerization. Departments and major areas included: water pumping, treatment, storage and distribution; metering and billing; accounting and personnel records; inspection and maintenance; and utility operations. Discriminant analysis revealed strong significant differences between utilities that plan to use computers and those that do not. There is a rather limited use of computers in the tri-state area. Fifty-one percent of the water utilities in Kentucky do not use computers at all in their operations. In Ohio and Indiana the figures are 39% and 51%. Many utilities use computers only for billing. The major form of recordkeeping in water utilities in the tri-state area is manual. Water loss in many systems appears to be a problem in Kentucky. Enormous potential exists in small and medium sized utilities for computerization to improve operational efficiency. (Moore-IVI)
W86-00795

TRENDS IN DRINKING WATER TREATMENT THE SHAPE OF THINGS TO COME,
Metcalf and Eddy of New York, NY.
G. P. Fulton.
Public Works, Vol. 116, No. 6, p 80-83, 138 and 140, June, 1985.

Descriptors: *Drinking water, *Water treatment, *Future planning, Modernization, Filtration, Organics removal, Disinfection, Chlorination, Measuring instruments, Costs, Manpower.

Treatment systems of the future will be different from older systems as water purveyors use innovative techniques to achieve solutions to particular water quality problems at particular sites. Earlier designs employed a 'worst case' solution, which tended to introduce redundancy of equipment and high cost. Future systems will control intermittent quality problems (eg, giardiasis, viral epidemics, accidental waste spills, leaching from waste dumps, and pesticide contamination) with approaches designed for the conditions at a given locality. The preeminent changes likely to occur in surface water treatment for drinking should be in filtration, organics removal, and disinfection. Both operational and equipment innovations will be employed to improve filtration results. In the interim period before final regulations for organics are established, primary emphasis will probably be on multi-purpose measures that moderate potential organic contamination problems, including aeration or air stripping, air flotation, granulated organic carbon filter media, and ozonation. Accepted disinfection alternatives to conventional chlorination are chloramines, chlorine dioxide, and ozone. Monitoring and control systems are becoming more complicated, with greater reliance on computers for both data recording and operations; the greatest changes will occur in instrumentation. Staffs at treatment plants will become smaller, but more highly trained, as equipment becomes more sophisticated. Future plants wil be customized designs, each intended to cope with particular source water quality features. Use of multi-purpose unit process elements will be more common to both optimize performance and reduce treatment costs. (Rochester-IVI)
W86-00805

UTILITY BATTLES IRON AND MANGANESE,
Hibbing Public Utilities Commission, MN.
R. P. Richards, and S. N. Foellmi.
Public Works, Vol. 116, No. 6, p 91-95, June, 1985. 4 Fig, 1 Tab.

Descriptors: *Water treatment, *Drinking water, *Iron removal, *Manganese removal, *Hibbing, *Minnesota, Pilot plant studies, Water supply, Municipal water, Oxidation, Chlorine, Potassium permanganate.

Computer analysis and a pilot plant study were employed to develop an increased capacity and improved water quality in a supply system deriving all its water from wells. The water-supply system, located in Hibbing, in the heart of the northeastern Minnesota iron mining district, had a history of problems with high iron and manganese (exceeding Environmental Protection Agency (EPA) Secondary standards in flow from all its wells but one). In redesigning the system, four alternatives were examined in which water from the Scranton (high quality water) wells would be pumped to the distribution system, where it would be blended with effluent from a treatment plant that would process the water from the other wells. Chemical oxidation with chlorine and potassium permanganate and continuously regenerated manganese greensand pressure filters was shown through analysis to be the most cost-effective treatment process. A pilot plant test showed that this treatment method could reduce the iron and manganese contents below EPA limits; the pilot test also provided filter loading rate, filter run time, maximum head loss across the filter, and the chemical feed dosage data that were useful in designing the full-scale plant. The water treatment plant was placed on line in early 1984, and the flow rate has averaged 1.9 million gallons/day (mgd), with a peak production of 3.2 mgd. Finished water has consistently met all regulatory agency standards. The pilot plant work provided an excellent projection of the full-scale plant chemical treatment requirements. Treatment cost for iron and manganese removal (chlorine and potassium permanganate) has been about $24/million gallons. (Rochester-IVI)
W86-00807

CITY IMPLEMENTS TRIHALOMETHANE CONTROL PROGRAM,
Neel-Schaffer, Inc., Jackson, MS.
J. G. Sigman, and W. M. Ashley.
Public Works, Vol. 116, No. 6, p 98-99, June, 1985. 1 Fig, 2 Tab.

Descriptors: *Trihalomethanes, *Water treatment, *Jackson, *Mississippi, *Drinking water, Source of pollutants, Chlorination, Water pollution control, Filtration, Sedimentation.

The city of Jackson, Mississippi has successfully initiated an ammoniation program to bring trihalomethane (THM) levels down to meet National Interim Primary Drinking Water Regulations. In 1975, the total THM in water in Jackson was 334 ppb, primarily as a result of increasing urbanization along the banks of the Pearl River upstream from where the treatment plant withdraws source water. A variation to the usual chloramination design that was used here was carrying a free chlorine residual through part of the treatment process, which was done in response to the following local conditions: (1) onsite storage at the plant is limited, with only 6-10 hr between flash mixing and finished water pumping, (2) the Pearl River exhibits great fluctuations in bacterial quality, (3) the 28 rapid sand filters at the plant are exposed, and (4) it was decided to change the disinfection systems from pre- and post- chlorination to mid-point (after sedimentation and before filtration) chlorination and post (just prior to finished water pumping) ammoniation. Pre-start-up monitoring showed that in every quarterly sample from January 1981 through August 1983, the 100-ppb limitation for total THMs was exceeded, with an average typically around 200 ppb, but running to as high as 450 ppb. In the quarters since startup, there has been a 70% reduction in total THMs, with the average quarterly value at six sample points being around 84 ppb. Consumers report that as a result of elimination of the free chlorine residual the water tastes better. (Rochester-IVI)
W86-00808

REMOVING VOC FROM GROUNDWATER; PILOT, SCALE-UP, AND OPERATING EXPERIENCE,
CH2M Hill, Inc., Corvallis, OR.
W. D. Byers, and C. M. Morton.
Environmental Progress, Vol. 4, No. 2
May, 1985. 9 Fig, 4 Tab, 14 Ref.

Descriptors: *Volatile organic compou
treatment, *Tacoma, *Washington, *G
contamination, *Air stripping, Tetrach
Dichloroethylene, Trichloroethylene,
oethylene, Chlorinated hydrocarbon
compounds.

A pilot study of packed tower air st
lowed by observations on performanc
scale facility, demonstrated the viabilit
effectiveness of this technique for remo
tile organic compounds (VOCs) from
The initial analysis and subsequent pilot
conducted in response to the discove
300 micro-g/l of 1,1,2,2-tetrachloroe
micro-g/l of trans-1,2-dichloroethylene
g/l of trichloroethylene, and 5 micro-g
loroethylene in well water in Tacom
ton. The pilot study was conducted in
air and water at ambient temperature
with total VOC concentration in the
about 700 micro-g/l, and air and water
C, with a total VOC concentration of
micro-g/l. The Onda method of pred
transfer coefficients for the scaled-up
the plant was used because the presen
others had indicated good agreement
Onda model and data taken on differ
packing, column sizes, and different
The full-scale facility consisted of five
in diameter, packed to a depth of 20 ft
polyproplylene saddles. Water flow pe
700 gallons/minute; running in paralle
could handle 3,500 gallons/minute.
have consistently removed 94-98% of
1,1,2,2-tetrachloroethane, with an ave
removal. Other compounds were esse
tected in the effluent during norma
indicating overall VOC removal ef
excess of 98%. The installed cost of t
system was approximately $750,000.
IVI)
W86-00816

**PACKED TOWER AERATION STRI
LOROETHYLENE FROM GROUND**
Air Force Engineering and Services
dall AFB, FL.
R. L. Gross, and S. G. TerMaath.
Environmental Progress, Vol. 4, No.
May, 1985. 10 Fig, 3 Tab, 15 Ref.

Descriptors: *Water treatment, *
contamination, *Air stripping, *Trichl
Chlorinated hydrocarbons, Granulate
carbon, Operating costs, Capital cos

Laboratory determination of Henry's
mathematical estimation of appropriat
were used directly in the design of
packed tower air stripper using 16 mm
remove trichloroethylene (50-8,000
from water. The prototype packed t
used two towers that could be opera
series or in parallel. Performance gene
ed design goals, with single tower rem
86-98% and series operation removal
99.9%. Higher volumetric air/water
gave better removal up to a value of
improvement for G/L above that valu
capacity for the prototype system is 4,
in parallel or 2,270 liter/min in serie
pected bacterial growth occurred in
pers during the first few months of
involved eight different, non-patho
nisms, and the accumulation was suf
crease head loss to a point where oper
be stopped and the packing cleaned. P
um hypochlorite chlorination was i
prevent recurrence of the growth, bu
calcium hypochlorite chlorination wa
Comparison of the air stripping tower
granular activated carbon system pre
to treat the same waste stream show
capital and operating costs for the
method were very much lower, with

per 1,000 liters of $0.26 versus $0.03, respec-
. (Rochester-IVI)
00817

OVAL OF NATURALLY OCCURRING
POUNDS BY COAGULATION AND SEDI-
TATION,
Dempsey.
Critical Reviews in Environmental Control,
4, No. 4, p 311-331. 10 Fig, 145 Ref.

iptors: *Water treatment, *Coagulation,
nentation, *Aluminum, Chemical reactions,
e-layer compresssion, Charge neutralization,
ption, Heterocoagulation, Polyelectrolytes,
lity, Color.

nisms for destabilization of contaminants
the process of coagulation, the chemistry of
um in water, and the removal of contami-
by coagulation, are reviewed including
of the coagulation process. The terms co-
on and flocculation have been used in the
re in ways that lead to semantic confusion.
ilization of particles in coagulation can
y at least four mechanisms: (1) double-layer
ssion, (2) charge neutralization, (3) forma-
a sweep floc leading to adsorption or heter-
lation of the contaminant, and (4) bridging
molecular-weight polyelectrolytes. Con-
al water treatment is oriented toward re-
of turbidity (the most common surrogate
er for particles) and sometimes color. Ma-
or which removal techniques have been
ed include clays, microorganisms, asbestos,
organic materials, inorganic solutes, and
ganic substances. Models of the coagula-
cess that apply to the techniques employed
gulation of contaminants include particle
and size distributions, integral analysis of
lant performance, micromix theory, and
f coagulant reactions. (Rochester-IVI)
355

OYING PYROGENS IN WATER,
ty Council Research Centre, Capenhurst
).
r, S. Poole, and F. M. Taylor.
and Water Treatment Journal, Vol. 25,
119-124, April, 1985. 2 Fig, 6 Tab, 12 Ref.

ors: *Pyrogens, *Water treatment,
*Bacterial toxins, *Toxins, *Ultraviolet
, Escherichia, Shigella, Public health.

/ozone method for removing pyrogens
d using Escherichia coli endotoxin as the
gen. An apparatus consisting of a flow-
ozonizer, followed by a 5-liter reaction
r exposure to UV (254 nanometer) light
w-pressure mercury lamp, rendered dilute
of E. coli endotoxin pyrogen-free. Pyro-
nce or absence was determined by the
amoebocyte lysate test. Both UV light
e were essential for the efficiency of the
The rate of destruction of pyrogen was (1)
tly dependent on the pyrogen concentra-
ndependent of the nominal concentration
in the aqueous phase, above 1 ppm, and
sed as the UV irradiation intensity was
The presence of 0.9% w/v of sodium
n the solution did not affect the reactions
ce. In a typical experiment it took 30 min
100 nanogram (ng)/ml E. coli endotoxin
the lysate sensitivity of 0.4 ng/ml. Solu-
, 40, and 200 ng/ml of Shigella dysenter-
ubjected to 1 hr of UV/ozone treatment,
ree passed the 'Test for Pyrogens' using
ochester-IVI)
)

ENCE OF CHLORINATED POLYNU-
AROMATIC HYDROCARBONS IN
ER,
nst. for Environmental Studies, Tsukuba
iv. of Chemistry and Physics.
y bibliographic entry see Field 5B.

5G. Water Quality Control

SECURITY OF GROUNDWATER CATCHMENTS NEAR RIVERS; CHARTS TO DETERMINE THE VARIATION IN THE REPLENISHMENT FLOW (SURETE DES CAPTAGES D'EAU SOUTERRAINE A PROXIMITE DES RIVIERES; ABAQUES POUR DETERMINER L'EVOLUTION DU DEBIT DE REALIMENTATION FLOW),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 2F.
W86-00656

RE-EVALUATING THE EXTENT OF GROUNDWATER CONTAMINATION,
National Water Well Association, Worthington, OH.
J. H. Lehr.
Water and Pollution Control, Vol. 123, No. 3, p 16-18, May/June, 1985.

Descriptors: *Water management, *Groundwater supply, *Water supply development, *Groundwater pollution, Management, Decision making, Water resources development, Planning, Evaluating.

Through a series of assumptions, it is concluded that, even with groundwater pollution occurring, we have yet to pollute even 1% of the total groundwater supply. The initiation of new sources of groundwater pollution can be eliminated within the next 10 years which will put an end to ill conceived practices that brought about the problem in the first place. The existing contamination plumes will not have moved much further or polluted much more by then than they already have. The odds are that we will end up with 98% of the groundwater still unpolluted by the end of this century. Practices which have led to the path of wanton wastefulness are reviewed. The first course of action should be to implement some management options that will work. Also needed is an evaluation of where a lack of efficiency exists in using water and these practices should be eliminated. An evaluation of inefficient irrigation practices is one step. The conjunctive use of surface and groundwater can help reduce the impact of localized droughts. Perhaps one of the most neglected management options is that of artificial recharge. There is no loss to evaporation as with a surface reservoir and many sources of water, which normally flow out of the watershed, can be recycled and saved right there. (Baker-IVI)
W86-00686

PROTECTING WATER QUALITY IN THE MIDWEST: IMPACT ON TIMBER HARVESTING COSTS,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
For primary bibliographic entry see Field 5D.
W86-00720

ENVIRONMENTAL AUDIT. II. APPLICATION TO STREAM NETWORK DESIGN,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
For primary bibliographic entry see Field 7A.
W86-00723

STATUS OF NONPOINT SOURCE POLLUTION: ITS NATURE, EXTENT AND CONTROL,
Battelle Columbus Div., OH.
For primary bibliographic entry see Field 5B.
W86-00779

URBAN RUNOFF: POLLUTION SOURCES, CONTROL, AND TREATMENT,
Environmental Protection Agency, Edison, NJ. Storm and Combined Sewer Technology Branch.
R. Field.
Water Resources Bulletin, Vol. 21, No. 2, p 197-206, April, 1985. 2 Fig, 2 Tab, 101 Ref.

Descriptors: *Urban runoff, *Water pollution control, Storm wastewater, Water management, Land use, Drainage, Water storage, Wastewater treatment, Sewer systems, Water reuse, Water pollution sources.

This paper reviews progress on urban stormwater management and pollution control, with emphasis on non- and low-structurally intensive techniques along with the total system approach encompassing control-treatment. Many of the U.S. Environmental Protection Agency's demonstration-evaluation projects are presented to exemplify: Land Management Techniques, i.e., land use planning, best use of natural drainage, dual use of retention and drainage facilities required for flood control designed concurrently or retrofitted for pollution control, porous pavement, surface sanitation, and chemical use control; Collection Systems Control, i.e., catchbasin cleaning, flow regulators (including swirl and helical devices), and the new concepts of elimination or reduction of unauthorized cross-connections, in-channel/conduit storage and/or other forms of storage for bleed-back to existing treatment plants; Storage including in-receiving water storage; Treatment, i.e., physical/chemical, disinfection, and a treatment-control planning and design guidebook; Sludge and Solids Residue from Treatment; and Integrated Systems, i.e, storage/treatment, dual-use wet-weather flow/dry-weather flow facilities, and reuse of stormwater for nonpotable purposes. Recommendations for the future in the areas of: control based on receiving water impacts, toxics characterization and their control, sewer system cross-connections, integrated stormwater management, and institutional/sociological/economic conflicts are also presented. (Author's abstract)
W86-00781

FARMERS' ATTITUDES TOWARD NONPOINT POLLUTION CONTROL AND PARTICIPATION IN COST-SHARE PROGRAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
W. R. Kerns, and R. A. Kramer.
Water Resources Bulletin, Vol. 21, No. 2, p 207-215, April, 1985. 6 Tab, 14 Ref.

Descriptors: *Nonpoint pollution sources, *Water pollution control, *Attitudes, *Farms, *Cost sharing, Virginia, Loans, Taxes, Soil loss, Soil erosion, Public participation.

The success of government programs to control nonpoint source pollution depends upon attitudes toward those programs and the availability of technical and financial assistance. Applicants for the Rural Clean Water Program cost-share funding in Virginia possess different personal and operational characteristics than do nonapplicants. Factors associated with participation in the Rural Clean Water Program differed from those associated with the more traditional soil conservation programs. Discriminant analysis was used to differentiate between other farmers who may become applicants and nonapplicants. Farmers' attitudes toward various policy options for inducing implementation of nonpoint source management practices varied greatly. Farmers were most favorable to cost sharing, low-interest loans and tax credits, and least favorable to a soil loss tax. They were either very favorably or very unfavorably inclined toward cross-compliance between pollution control and other agricultural programs. (Author's abstract)
W86-00782

WATERSHED PLANNING FOR ACID MINE DRAINAGE ABATEMENT,
Georgia Univ., Athens. School of Environmental Design.
For primary bibliographic entry see Field 4D.
W86-00787

IN-LAKE WATER QUALITY MANAGEMENT PLAN FOR A RECREATIONAL LAKE IN CENTRAL ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality Section.

R. K. Raman, and R. L. Evans.
Water Resources Bulletin, Vol. 21, No. 2, p 315-321, April, 1985. 2 Fig, 3 Tab, 10 Ref.

Descriptors: *Water quality management, *Lake restoration, *Johnson Sauk Trail Lake, *Illinois, Eutrophication, Destratification, Algal control, Copper sulfate, Potassium permanganate.

Johnson Sauk Trail Lake (Illinois) remains highly eutrophic, even though the watershed has long been returned to an undisturbed condition with permanent vegetative cover and with little or no land disturbance in the watershed. Internal regeneration of nutrients has been identified as the major source of nutrients to the lake. Lake destratification, selective harvesting and removal of weeds, and control of algal blooms using chelated copper sulfate application followed by potassium permanganate application have all been chosen as management techniques for improving water quality conditions in the lake. These in-lake techniques are considered not as palliative measures, but as necessary tools in enhancing the lake's water quality characteristics. (Author's abstract)
W86-00794

ENVIRONMENTAL PROTECTION IN THE REPUBLIC OF IRELAND,
Trinity Coll., Dublin (Ireland). Environmental Sciences Unit.
N. F. Gray.
Effluent and Water Treatment Journal, Vol. 25, No. 3, p 83-89, March, 1985. 1 Tab, 11 Ref, 2 Append.

Descriptors: *Environmental protection, *Ireland, *Legislation, Protection, Water pollution control, Resources management, Water management.

Water quality maintenance laws and agencies in the Republic of Ireland were evaluated. Unlike many other European countries, no single body is responsible for, or coordinates, the management of water resources. The system is local authority-based, and relies heavily on state and semi-state bodies to carry out a number of important functions. Before the implementation of the Local Government (Water Pollution) Act of 1977, three pieces of legislation, the Public Health Act of 1979, the Fisheries (Consolidation) Act of 1959, and the Local Government (Planning and Development) Acts of 1963 and 1976, were widely used in the protection of waters and public supplies. The Water Pollution Act attempts to centralize the responsibility for water resource management with local authorities, but numerous other organizations still retain various statutory responsibilties in relation to water management and pollution control. The Water Pollution Act obliges local authorities to monitor and analyze discharges and receiving water, but few are able to do so without relying on other agencies for laboratory services. Many other organizations carry on monitoring programs; at present the data are not coordinated, but eventually a catchment area-based data collection system will be instituted by local authorities. The Water Pollution Act was also designed to satisfy the legislative requirements of the European Economic Community directives, which it has successfully done to date. The Water Pollution Act is clearly adequate to protect Ireland's water resources, and overlapping sections of other acts should be repealed to eliminate duplication of responsibilities and legislative confusion. A more coordinated, catchment-based water management system, with complete control of all water functions, would appear to be the most cost-effective way for efficient water resource management, particularly pollution control. (Rochester-IVI)
W86-00813

INNOVATIVE WATER QUALITY-BASED PERMITTING: A POLICY PERSPECTIVE,
Skylonda Group, Inc., Menlo Park, CA.
D. Downing, and S. Sessions.
Journal of the Water Pollution Control Federation, Vol. 57, No. 5, p 358-365, May, 1985. 22 Ref.

Descriptors: *Permits, *Water quality, Water pollution control, Costs, Nonpoint pollution sources, Water pollution sources, Administration, Environmental effects.

The Water Innovations Project (U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation) examined two generic types of permitting innovations: those that make greater use of the capacity of the water body to assimilate wastes, and those that encourage more efficient allocation of a given total wasteload through trading mechanisms. Innovations in the first group are seasonal permits, variable permits, seasonal standard and site-specific standards. Interplant source trades, point/nonpoint source trades, and banking comprise the second group. Cost effects, water quality eligible pollutants, and administrative issues associated with these permitting innovations were studied. All innovations would apply only where controls beyond technology-based standards are required to attain water quality standards. The innovations are most directly applicable to conventional pollutants and nutrients, not for toxics. Based on case analysis the innovations appear to provide large cost savings while protecting water quality. Administrative safeguards, such as criteria for particular pollutants when innovative permitting is used, or restrictions on situations in which innovative permitting can be employed, are needed to protect water quality and program integrity, while avoiding excessive administrative burdens. Analysis of case studies actual experience in states where these innovations are already in use indicated substantial cost savings, few if any adverse environmental effects, and manageable administrative burdens. In some states, innovative permitting broke regulatory impasses and led to earlier attainment of water quality standards than would otherwise have occurred. (Rochester-IVI)
W86-00839

CONTROL OF METAL APPLICATION RATES FROM SEWAGE SLUDGE UTILIZATION IN AGRICULTURE,
Anglian Water Authority, Huntingdon (England). Directorate of Scientific Services.
P. J. Matthews.
CRC Critical Reviews in Environmental Control, Vol. 14, No. 3, p 199-250. 4 Fig, 19 Tab, 166 Ref.

Descriptors: *Sludge disposal, *Metals, *Agriculture, *Environmental protection, Water pollution control, Fertilizers, Heavy metals, Arsenic, Boron, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Molybdenum, Nickel, Selenium, Zinc, Soil, Economic aspects.

Potentially toxic metals in sewage sludge and their chemistry in the sludge medium, potentially toxic metals in normal and sludged soils, chemical controls on metal availability, and the effect of potentially toxic metals on crops and the agricultural consequences of their presence, are reviewed, and recommendations for controlling the application of sludge to land are presented. Chemical elements of interest in this field are arsenic, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, and zinc. A survey of sludge disposal in the United Kingdom in 1980-81 showed that disposal of sludge on general arable land and marine dispersal accounted for more than half of the ultimate disposal of sewage sludge. The use of sewage as a fertilizer should be controlled so as to meet the following objectives: (1) avoid spread of human, animal, and plant diseases, (2) avoid public nuisance, particularly odors, (3) avoid harm to crop quality and yield resulting from soil contamination, (4) protect surface and ground waters, and (5) provide an acceptable and useful service to farmers. Application of metals to agricultural land may be controlled by limiting their concentrations in sludge, limiting their concentrations in sludge-amended soils, and limiting the rate of accumulation of metals in soil. Approaches used in deriving guidelines differ according to whether regional soils are acidic or alkaline. Industrial effluent control is an important element of controlling sludge metal concentrations; presence of industrial metals may be a factor in determining whether fertilization is an acceptable use for a particular sludge. At present, costs of removing metals from sewage sludge are prohibitive when compared to the value of the isolated metals. If the prices of metals rise, industrial d may decline, reducing the metal conten sludge, thus making metal recovery fro less, rather than more, economic. (Roche W86-00854

ALTERNATIVE APPROACHES TO AC CONTROL,
For primary bibliographic entry see Field
W86-00867

DISSOLVED OXYGEN CONCENTRATI FLORIDA'S HUMIC-COLORED WATE WATER QUALITY STANDARD IM TIONS,
Florida Inst. of Tech., Melbourne. Dept. ronmental Sciences and Engineering.
T. V. Belanger, F. E. Dierberg, and J. Rob
Environmental Chemistry, Vol. 48, No. 2 119, 1985. 6 Fig, 5 Tab, 15 Ref.

Descriptors: *Water quality standards, *Dissolved oxygen, *Humic-colored Swamps, Lakes, Streams, Humic waters, waters.

The Florida Department of Environment lation (DER) has established detailed oxygen standards for the various classes o water in the state. According to these st Class III Waters (recreation) should main solved oxygen levels above 5 mg/L. Many humic-colored aquatic systems (lakes, swa streams) rarely meet the established 5 mg ria. Four sites in east and central Florid differing degrees of humic color were inv three or four times in one year. The 24-hr oxygen levels at the sites varied form a low of 1.2 mg/L in a natural drainage mar mg/l in a man-made drainage structure. tems are generally very undersaturated spect to oxygen. It is believed that these c are natural and do not result from organ tion. In view of this data and a brief revie literature, it seems that the 5.0 mg/L oxygen standard for these and similar aqu tems is unrealistic. A better approach wo set standards based on the continued deter of the uniqueness of each system. (Mo W86-00901

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ADDRESSING SOCIAL AND ENVIRO TAL ISSUES IN WATER RESOURCES NING AND MANAGEMENT,
Florida Univ., Gainesville. Dept. of Envir Engineering Sciences.
W. Viessman, Jr.
Water Resources Bulletin, Vol. 21, No. 2 314, April, 1985. 2 Ref.

Descriptors: *Water resources deve *Planning, *Social aspects, *Environm fects, Education, Public information, Man Problem solving, Decision making.

Social and environmental goals and objec continually changing and often are dif quantify. Understanding social goals and o and incorporating them in water resour ning, management, education and en processes are keys to solving many cur emerging water resources problems. It wi essary to instruct students, lay-persons an sionals in the importance of their involv the areas of goal-setting and policy-str and on how to function effectively in a social-natural environment. The issue is ho information on viable alternatives to making bodies relative to the issues wit they are concerned. The objective is to well-informed choices, ones that are soc ceptable, technically sound and economic

Problem solving should be taught in the
of constraining influences, both natural and
Findings should be presented so that those
technical expertise can understand and use
Stronger interactions between practicing
onal and the faculties of universities may
such objectives. Professionals must have a
erception of the world outside their area.
IVI)
793

valuation Process

ING-WATER AND SANITATION
CTS: CRITERIA FOR RESOURCE AL-
ION,
Health Organization, Geneva (Switzer-
v. of Environmental Health.
ary bibliographic entry see Field 5F.
69

ANT RUNOFF MODELS: SELECTION
E IN DECISION MAKING,
iv., Durham, NC. School of Forestry and
ental Studies.
ary bibliographic entry see Field 5B.
30

TION AND DECISIONMAKING: THE
RIVER BASIN IN NEBRASKA,
Univ.-Lincoln. Dept. of Civil Engineer-

lliland, L. Becker, R. Cady, J. Gabig, and

sources Bulletin, Vol. 21, No. 2, p 281-
, 1985. 5 Fig, 4 Tab, 7 Ref.

rs: *Water management, *Water alloca-
te River Basin, *Nebraska, *Simulation,
making, Computer models, Water
ater quality, Environmental effects, Eco-
ects, Instream flow, Water diversion,
e, Wildlife.

conflict exists over water management
tion in the Platte River Basin of Ne-
interdisciplinary computer simulation
presenting the water quantity, water
vironmental, and economic dimensions
flict, was developed in order to analyze
fs among allocation scenarios. Most im-
decisionmakers and interest groups were
model development. Simulation results
case and two scenarios are presented.
io favors potection of instream flow for
e other favors waters diversions for
Impacts of the instream flow scenario,
d by the amount of land irrigated,
r levels, the amount of wildlife habitat
nd catfish, and net agricultural benefits
fer greatly from those of the base case.
mpacts of the diversion scenario were
On the negative side, instream flows
habitat declined an average of 39%;
e positive side, groundwater levels and
ural benefits each increased 6%. The
rocess was successful insofar as it pro-
nderstanding among the highly diverse
ups of the systems nature of the Basin.
nent on a water diversion schedule
of the parties has been reached, partly
of this process. More comprehensive
s have not yet been forged. This expe-
ever, indicates that modeling success at
aking level depends more on the extent
e policymakers understand the model
s on model sophistication. (Author's

D INSTITUTIONAL REQUIRE-

Commission on the Potomac River
ville, MD.
bibliographic entry see Field 6F.

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FARMERS' ATTITUDES TOWARD NON-POINT POLLUTION CONTROL AND PARTICIPATION IN COST-SHARE PROGRAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W86-00782

BARRIER TO UPGRADING FUNDING,
Purdue Univ., Lafayette, IN.
R. O. Walker, Jr.
Water Engineering and Management, Vol. 132, No. 5, p 20-28, May, 1985.

Descriptors: *Infrastructure, *Public policy, *Funding, Policy making, Decision making, Urban planning, Costs, Economic aspects, Cost allocation.

An August, 1984, workshop on 'Technical Alternatives for Urban Infrastructure' brought out several aspects of the infrastructure problem as faced by American cities. The problems of infrastructure are not merely physical, or engineering, problems, but have social, economic, community government, and regulatory aspects. Major social and economic changes, such as the change from an industrial to a service economy, mean that the demands made on the infrastructure are changing. The problem is not merely one of upgrading or repairing existing facilities, but of simultaneously adapting them to changing needs of the users. Funding for major projects is the greatest obstacle to infrastructure improvement now that federal support is being withdrawn. Aside from federal programs, funding methods that have been used include (1) revenue bonds, (2) New Jersey's infrastructure bank, from which local communities may borrow funds at low or no interest, (3) developer exactions, and (4) 'privatization' of the infrastructure. A coalition of all segments forming the framework of the urban infrastructure system and its users should be the source of the information required for the decision-making process. New methods of financing, marketing, and adoption of new technologies must be encouraged and supported. (Rochester-IVI)
W86-00797

OVERCOMING THE BARRIERS,
East Bay Municipal Utility District, Oakland, CA.
J. B. Gilbert.
Water Engineering and Management, Vol. 132, No. 5, p 28-33, May, 1985.

Descriptors: *Infrastructure, *Water conveyance, Management planning, Urban planning, Conveyance structures, Water rates, Economic aspects, Planning.

The problems of infrastructure in the water-supply systems of the United States tend to be concentrated in the older cities of Northeast, where deferred maintenance and unrealistically low water rates have created an accumulation of system problems. Four main areas that each utility manager should address before looking for assistance in resolving problems of inadequate and decaying infrastructure are: (1) an effective preventive maintenance program, (2) a capital program of replacement and improvement as part of the future planning process and annual budget, (3) an equitable water rate structure - sufficient to pay annual costs, including debt service, of a comprehensive rehabilitation program, and (4) a system of charges that places the burden of financing facility expansion on those customers causing the need. The infrastructure barriers are essentially internal to each utility. The ability to use external assistance exists, but for political and other reasons, such assistance may be severely limited in the future. As an enterprise, the water industry is uniquely capable of solving its infrastructure problem because of its particular internal ability to establish water rates that can produce a revenue stream sufficient to pay all operating costs, as well as debt service required to rehabilitate and expand deficient facilities. (Rochester-IVI)
W86-00798

ALTERNATIVE SOLUTIONS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. J. Boland.
Water Engineering and Management, Vol. 132, No. 5, p 33-39, May, 1985. 3 Ref.

Descriptors: *Infrastructure, *Management planning, *Economic aspects, Funding, Privatization, Legal aspects, Planning.

Water/wastewater utilities with infrastructure problems are typically those in need of substantial amounts of capital. The solution to the capital problem consists of two steps: (1) increasing rates sufficiently to halt the erosion of existing capital and to provide for repayment of borrowed funds, and (2) raising needed capital from subsidies, debt proceeds, or current revenues. Within the public sector, subsidy may be disappearing as an option as federal and state government trim their budgets. Long-term debt, through such agencies as 'bond banks' or by conventional, but previously unused, debt sources is one alternative available to the utility manager. For systems with facilities in imminent danger of failure, or to keep capital costs low, short-term debt is appropriate. Sometimes market conditions may actually provide lower rates for short-term instruments. Privatization of all or part of the physical facilities is a method of financing that depends entirely on federal tax law, which provides tax benefits to those acquiring the utility. These indirect subsidies from the federal treasury may permit utilities to acquire needed facilties at a lower cost than would be possible under the public finance alternatives. Institutional changes may also help. For example, a utility could be merged with a stronger utility to provide improved credit and better cash flow. Horizontal mergers are frequently advocated to improve operational efficiency and quality of service, as well as to provide improved access to capital, whereas vertical mergers are often proposed as last-resort solutions to fiscal emergencies. (Rochester-IVI)
W86-00799

FLOTATION THAT MIGHT SINK,
For primary bibliographic entry see Field 6E.
W86-00831

BYZANTINE ART OF WATER UTILITY RATEMAKING,
Water and Wastewater Equipment Mfrs. Association, Washington, DC.
F. Summer.
Environmental Forum, Vol. 4, No. 1, p 32-38, May, 1985. 10 Ref.

Descriptors: *Economic aspects, *Water treatment, *Utilities, *Costs, Public policy, Management planning, Water distribution.

Factors affecting the setting of water rates are discussed. Water industry costs have two major sources: environmental and health-related requirements and the costs of repair and rehabilitation of facilities. Deferred maintenance is common among utilities, but nearly half of the utilities could eliminate their backlogs through stepped-up construction programs over a 10-yr period. Setting water rates involves a process of matching the costs of providing service to the unique economic, political, and social environments in which a utility provides service. Two methods are generally used for determining total revenue requirements: the case or budget basis and the utility basis. Equitable allocation of costs among customer classes required determination both of the amount of water required by each class and of the peak needs of each customer. Most rate structures used by water utilities include stepped decreases as consumption increases; different classes of customers create different load characteristics. Connection charges help finance new construction and recover some capital costs. Fire protection (hydrant) rates

depend on where a particular hydrant is located (public or private property) and who is responsible for its upkeep. Ultimately, public utility commissions control the rates for most investor-owned systems and for some publicly-owned utilities. The public and its representatives sometimes express the view that water is free, or that water rates should be limited, regardless of the utility's expense in providing it. Costs of water must reflect the benefits derived from it. (Rochester-IVI)
W86-00868

6D. Water Demand

NEW RULES FOR NATIONAL FOREST WATER,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
J. Romm, and K. Bartoloni.
Journal of Forestry, Vol. 83, No. 6, p 362-367, June, 1985. 4 Fig, 3 Ref.

Descriptors: *National forests, *Water rights, *Forests, *Legal aspects, Riparian rights, Organic Act, Federal Land Policy and Management Act, Multiple Use-Sustained Yield Act, Resource allocation, Water allocation.

The decision of the U.S. Supreme Court in the 'Rio Mimbres' case limited the federal reserved right to water, under which the Forest Service had been claiming water for all its various uses of reserved land. Based on an interpretation of the Organic Act of 1897, the court limited the Forest Service's claim to water to that necessary for maintaining timber supplies and favorable water flows. Other uses, such as recreation, fish and wildlife needs, and aesthetics, were not included. Four strategies have been employed by the Forest Service to attempt to regain lost water rights. First, a hydrological argument has been advanced, based on the 1897 Organic Act, that enough water must be allowed to flow through rivers to keep the drainage network in good condition. In California, the Forest Service has asserted its 'riparian rights' as a property owner, to which it is entitled under that states' laws. As a third strategy, the Forest Service is testing the extent of its powers to regulate private uses of national forest water under the Federal Land Policy and Management Act of 1976. Its permit authority under this act may allow it to confine the scope of private water use within national forest boundaries and to expand its control of water allocation. In a fourth strategy, the Forest Service is contending in court that the Multiple Use-Sustained Yield Act of 1960 implied the same reserved rights for 'supplemental' purposes after 1960 as the Organic Act implied for the maintenance of timber supplies and favorable stream flows. Other strategies available include exercising eminent domain power to buy water rights and various cooperative agreements with states and federal agencies for joint management of water and sharing of costs. (Rochester-IVI)
W86-00716

6E. Water Law and Institutions

NEW RULES FOR NATIONAL FOREST WATER,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
For primary bibliographic entry see Field 6D.
W86-00716

SALINITY ISSUES AND WATER DEVELOPMENT IN THE GREEN RIVER BASIN, WYOMING,
Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
S. D. Cooke, and J. Ahern.
Water Resources Bulletin, Vol. 21, No. 2, p 217-223, April, 1985. 2 Fig, 11 Ref.

Descriptors: *Water resources development, *Salinity, *Green River Basin, *Wyoming, Water allocation, Colorado River Compact, Upper Colorado River Basin Compact, Appropriation, Downstream.

Water development in the Green River Basin of Wyoming is projected to increase salinity downstream in the Green River and Colorado River, and thereby increase salinity costs to users of water from these two rivers. Despite these water quality and economic impacts to downstream water users, Wyoming will probably be able to develop its currently unused but allocated water supplies of the Green River Basin. The Colorado River Compact and Upper Colorado River Basin Compact are binding, and protect Wyoming's share of the Colorado River System waters for future use. The argument that water may be used to greater profit downstream is not sufficient to reduce Wyoming's allocation. In addition, the no-injury rule under the appropriation doctrine of law does not appear to protect prior downstream appropriations from increasing salinity in this case. (Author's abstract)
W86-00783

FLOTATION THAT MIGHT SINK,
F. Pearce.
New Scientist, Vol. 106, No. 1452, p 16-19, April, 1985.

Descriptors: *Privatization, *Public policy, *Water authorities, *Organizations, *England, *Wales, Water treatment facilities, Water districts, Maintenance, Economic aspects, Infrastructure.

None of the 10 regional water authorities in England and Wales that the British government plans to sell to the private sector is without serious infrastructure problems in both the water supply and water treatment phases of its operations. The considerable age of many of the mains, reservoirs and treatment plants, and the fact that maintenance has been significantly curtailed as an economy measure since the mid-1970s, contribute to the major capital needs that these authorities have. Water supplies in many places have severe leaks, bacteriological standards are not met in some cases, Nais worms have been found in the water supply in Sussex, sewer collapses in Yorkshire (64 per 1,000 km of sewer), and problems with inadequate recordkeeping in Wales, are among the numerous problems facing the authorities involved. Many water supplies fail to meet European Economic Community standards. The water authorities (North West, Southern, Yorkshire, Thames, Welsh, South West, Severn Trent, Northumbrian, Wessex, and Anglian) have assets valued at 26 billion pounds sterling, but many of the authorities have hundreds of millions of pounds in deferred maintenance or capital spending that must be done to correct significant problems. In many areas the quality of both drinking water and effluent from treatment plants is declining rather than improving under current management. Investors may be reluctant to take on the responsibility of upgrading the seriously deteriorated facilities that would become theirs if they were to buy them from the government. (Rochester-IVI)
W86-00831

ALTERNATIVE APPROACHES TO ACID RAIN CONTROL,
E. M. Trisko.
Environmental Forum, Vol. 3, No. 12, p 18-23, April, 1985. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Acid rain, *Water pollution control, *Clean Air Act, *Legislation, Legal aspects, Air pollution, Nitrogen oxides, Sulfur dioxide, Organic compounds, Emission density zoning.

Because Section 126 of the Clean Air Act does not treat acid rain as a pollutant, downwind states have appeared to be at the mercy of upwind polluters. However, acid precipitation can be reduced by enforcing the existing Clean Air Act. At least two mechanisms are now available to EPA: a fine particulate matter standard for sulfates developed under Sections 108 and 109, and enforcement of Section 169A's visibility protection program. If Congress insists on a special legislative remedy for acid rain, existing Clean Air Act programs and principles could supply the foundation for an integrated approach to acid rain control and visibility enhancement. Compared to the emission reduction allocation methods in the principal House and Senate acid rain bills, a new approach emission density zoning would be more both with the Act's uniform standards- proach, and with current scientific unde of atmospheric transport and deposition rection of the Clean Air Act reautl debate may change as a result of new indication that emissions of nitrogen volatile organic compounds may have effect on forests. Eventually, Congress w address the major policy issue underlyin rain debate: whether the Clean Air Act protects the environmental values Con intends to protect. (Moore-IVI)
W86-00867

6F. Nonstructural Alternative

TIME AND INSTITUTIONAL R MENTS,
Interstate Commission on the Potom Basin, Rockville, MD.
D. P. Sheer.
Water Engineering and Management, No. 5, p 14-20, May, 1985. 1 Tab.

Descriptors: *Infrastructure, *Water di *Washington (District of Columbia), S analysis, Computers, Water conveyance.

The value of existing water-supply infr for serving current and future water-sup lems is demonstrated by the case of the ton (District of Columbia) Metropoli (WMA). Three major water-supply sy developed to supply WMA as it grew to tion of 3 million people. By 1977, it was serious risk of supply shortfall during dr isted, and studies were conducted of s provements to the present system, which million to $1 billion and raised numero tions from affected individual and agenci nalysis of the operations of the individu nents of the WMA distribution system, volved three independently-operated sy vealed that coordinated operations co better use of available storage and Poto flow, and interconnections among reserv proposed to facilitate this task. Furt showed, however, that no construc needed at all, and that the existing d system could provide the year 2030 req without lowering the reservoirs below capacity. This surprising result was di water managers to understand. Comp simulation games allowed managers and to grasp the concepts that analysts had culty explaining. As the plan was fina computer simulation model also helped r issue of cost sharing, by letting each ut its own runs under different hypothetic tions, to test the proposed operating ru dreds of simulation runs were made, usin droughts and assumptions, before the uti satisfied that an equitable allocation of been devised. The WMA case shows hov infrastructure' can be made an asset, rat liability needing replacement. (Rochester-
W86-00796

INNOVATIVE WATER QUALITY-BAS MITTING: A POLICY PERSPECTIVE,
Skylonda Group, Inc., Menlo Park, CA.
For primary bibliographic entry see
W86-00839

6G. Ecologic Impact Of Water Development

INVERTEBRATE COLONIZATION R THE TAILWATER OF A KENTUCKY CONTROL RESERVOIR,
Fish and Wildlife Service, Bowling G East Central Reservoir Investigations.
W. D. Swink, and J. F. Novotny.
Journal of Freshwater Ecology, Vol. 3, 27-34, June, 1985. 3 Tab, 17 Ref.

ptors: *Invertebrates, *Tailwaters, *Flood-
dams, *Kentucky, Recolonization, Aquatic
Oligochaetes, Dam effects, Reservoir re-
Flow discharge, Detritus, Periphyton.

poundment and operation of a flood-control
ir often produce major changes in the flow
immediately below the dam. Discharges
tailwater are determined by the method of
peration and downstream water require-
In the tailwaters below some flood-control
irs, prolonged periods of low discharge
followed by sustained high flows. Inverte-
olonization on newly introduced rock sub-
was examined from July through October
the tailwater of Barren River Lake, Ken-
Rock substrates were examined because
often used as riprap in tailwaters to pre-
sion. Chironomidae, the dominant taxon of
insects, reached full colonization by day
nization by Oligochaeta, the other major
rate taxon, was not completed by the end
5-day period of observation. Recoloniza-
have been delayed because insufficient
riphyton and detritus) had accumulated on
rocks. Rapid recolonization of dewatered
s may be especially critical for maintain-
uate fish food in tailwaters of flood-con-
voirs. (Moore-IVI)
18

OS-PLANKTON RELATIONSHIP UP-
I AND DOWNSTREAM OF A BLACK-
IMPOUNDMENT,
Power and Light Co., New Hill, NC.
ergy and Environmental Center.
rlong, and M. A. Mallin.
f Freshwater Ecology, Vol. 3, No. 1, p
e, 1985. 4 Fig, 3 Tab, 24 Ref.

rs: *Benthos, *Plankton, *Reservoirs,
reek, *South Carolina, Upstream, Down-
am effects, Invertebrates, Zooplankton,
kton, Aquatic insects, Organic matter,
e matter.

plankton, zooplankton, and the macroin-
snag cummunities of Black Creek,
olina, upstream and downstream of an
ent were investigated during 1982. Phy-
and zooplankton densities upsteam of
ndment were very low. The reservoir
ontributed a large part of the zooplank-
izes to the stream immediately below the
ent. Large copepods and cladocerans
st absent from the community 2.2 km
n leaving mainly nauplii, small clado-
rotifers. The reservoir also released a
mount of phytoplankton into the stream
only slightly reduced further down-
e macroinvertebrate snag community
f the impoundment was diverse and was
by the filter feeders Simulium and
rsus. The community immediately
n of the impoundment displayed de-
ersity and was dominated by the filter-
ddisflies Hydropsyche and Neureclipsis
is. Further downstream, the communi-
increased diversity and a community
esembling that above the impoundment
anytarsus dominating the filter feeders.
eeders above the impoundment utilized
trafine particulate organic matter
hich was probably in the form of bacte-
tus. Immediately below, the caddisfly
utilized larger fine particulate organic
developed as a response to the input of
on entering the system. Further down-
return of a more diverse community
POM paralleled the absence of large
and the retention of phytoplankton
ooplankton in the system. (Author's

G THE CUMULATIVE EFFECTS OF
PRACTICES ON DOWNSTREAM
ECOSYSTEMS,
ssociates, Wenatchee, WA.

oil and Water Conservation, Vol. 40,
No. 2, p 237-241, March/April, 1985. 4 Fig, 4 Tab, 12 Ref.

Descriptors: *Model studies, *Forest management, *Environmental effects, Forest watersheds, Forestry, Watersheds, Management, Water quality, Water quantity, Ecosystems, Computer models.

By modeling key watershed parameters affecting the quantity and quality of water delivered to downstream ecosystems, the KWCEA (a Watershed Cumulative Effects Analysis) model provides an annual index of a watershed's hydrologic condition. The index value implies the cumulative-effects risk that must be assumed with past, current or future watershed forest practices. Of the seven model components, only two require professional judgement - the potential slope stability failure frequency and the time period for a disturbed area within a watershed to become hydrologically mature. Guides are provided to assist in making these judgements. A computer model greatly reduces the time needed to calculate the KWCEA values. The model is particularly useful for evaluating forest practice options within a watershed during planning. Potential levels of downstream impacts can be estimated. The worst-case KWCEA index value or the implied cumulative-effects risk can be calculated and compared with present or future scheduled levels of watershed activity. The output from the KWCEA model provides a much needed data base to coordinate forest activities among several landowners within a watershed. (Baker-IVI)
W86-00651

CHANGES IN SOIL CARBON AND NITROGEN DUE TO IRRIGATION DEVELOPMENT IN NEBRASKA'S SANDHILL SOILS,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
M. A. Lueking, and J. S. Schepers.
Soil Science Society of America Journal, Vol. 49, No. 3, p 626-630, May-June, 1985. 2 Fig, 5 Tab, 22 Ref.

Descriptors: *Irrigation effects, *Soil chemistry, *Carbon, *Nitrogen, *Nebraska, Hydrolyzable nitrogen, Mineralizable nitrogen, Soil depth.

Carbon and N parameters were compared for non-developed and developed soils (predominantly mixed mesic, Typic Ustipsamments, and sandy, mixed mesic Entic Haplustolls). Soil samples were collected from four developed center pivot irrigation sites and from the nondeveloped corners at depth increments of 0- to 75-, 75- to 150-, and 150- to 300-mm. Total C, total Kjeldahl N (TKN), hydrolyzable N, and mineralizable N by autoclave and by 112-d incubation study were determined. Changes in TKN were not significant in the 0- to 75-mm, depth, but in the second depth increment, TKN increased with development (507 to 569 kg/ha). Total C also increased at this depth (5650 to 6400 kh ha-1). The C/N ratio increased with development in the surface 75 mm (11.5 to 12.2). Inorganic N increased in the top 300 mm due to development. Mineralizable N by both techniques increased in the 75- to 150- and 150- to 300-mm depth increments. Steady state values for ln TKN were calculated to be 6.6, 6.4, and 6.8 kg/ha for soil depth increments of 0- to 75, 75- to 150-, and 150- to 300-mm, respectively. The ln total C steady-state values were 9.1, 8.8, and 9.1 kg/ha. In some cases, undeveloped soil contained more N and C than these steady-state values, suggesting that development tended to decrease the soil test values. If the undeveloped soil was lower in N or C than the steady-state value, development tended to increase the test value. Total C, TKN, hydrolyzable N, mineralizable N (both techniques), and inorganic soil N were all highly correlated. Changes in TKN and total C were not correlated to landscape position or time since development. (Author's abstract)
W86-00703

NET BENEFIT MODEL FOR RECREATION PLANNING AT DRINKING WATER RESERVOIRS,
Fitchburg, MA.
For primary bibliographic entry see Field 6G.
W86-00792

NET BENEFIT MODEL FOR RECREATION PLANNING AT DRINKING WATER RESERVOIRS,
Fitchburg, MA.
J. J. Behan, M. Gross, and L. R. Klar, Jr.
Water Resources Bulletin, Vol. 21, No. 2, p 297-309, April, 1985. 3 Fig, 6 Tab, 23 Ref. Department of the Interior project B-078-MASS.

Descriptors: *Recreation, *Environmental effects, *Reservoirs, *Model studies, *Planning, Quabbin Reservoir, Massachusetts, Water quality control, Cost-benefit analysis, Carrying capacity, Multipurpose reservoirs, Nutrients, Drinking water.

A management model was developed for determining levels of recreation activities at public drinking water reservoirs. Quabbin Reservoir, located in central Massachusetts, served as a case study for the model. An interdisciplinary research team was formed to study the impact of selected recreation activities on water quality, public demand and willingness to pay for selected recreation activities, carrying capacity constraints, and the economic cost/benefits associated with increases in recreation at the Quabbin Reservation. Study variables were integrated into a quadratic programming model, producing the number of participants that corresponds to maximum net benefits for specific development packages on design days. The reaction mix associated with maximum net economic benefits was found to be cost-effective (assuming the use of reasonable entrance fees) and not deleterious to water quality. However, as a result of the findings of a related study, it was recommended that nutrients, particularly from wastewater, not be permitted to enter the reservoir, since the current phosphorous level may be at a critical point. Management techniques that would safeguard against the occurrence were recommended. The model was sensitive to management objectives; recommendations were limited to activities that would not lower the existing high quality of Quabbin water. (Author's abstract)
W86-00792

IMPACT OF HYDRAULIC WORKS ON WATER QUALITY, PART TWO,
Electricite de France, Chatou. Direction des Etudes et Recherches.
R. Gras, and J. P. Albignat.
International Water Power and Dam Construction, Vol. 37, No. 5, p 41-46, May, 1985. 11 Fig, 1 Tab, 12 Ref.

Descriptors: *Environmental effects, *Water quality, *Hydraulic structures, Mathematical models, Navigation, Irrigation, Flood control, Ecological effects, Management.

All hydraulic projects, including those to meet quantitative needs (navigation, irrigation, and flood control) have a definite effect on the quality of water, but the magnitude of change to an ecosystem is not always related to the size of the associated hydraulic project. Appropriate design or good management of a project can limit a particular effect on the water quality, although it is necessary to have criteria to follow. Mathematical models allow the problems of conflicting criteria to be analyzed with respect to the estimation of the effects, or to the improvement of the design and selection of proper management. The actual scope for adapting management to meet water quality criteria is limited. (Moore-IVI)
W86-00802

HYDROLOGIC AND VEGETATIONAL CHANGES RESULTING FROM UNDERGROUND PUMPING AT THE CYPRESS CREEK WELL FIELD, PASCO COUNTY, FLORIDA,
Southwest Florida Water Management District, Brooksville.
T. F. Rochow.
Florida Scientist, Vol. 48, No. 2, p 65-80, 1985. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Wells, *Environmental effects, *Vegetation, *Hydrology, *Cypress Creek Well Field, *Florida, Pumping, Cypress domes, Marshes, Surface water, Aquatic plants, Wetlands.

From 1975-1982 the hydrologic and vegetation response of selected cypress domes and marshes in the Cypress Creek Well Field (Florida) to deep underground pumping was compared to similar sites far removed from water production activities. After water production began, 5 of the 7 wellfield study sites experienced 1 to 5 consecutive years without standing surface water. Control sites had some surface water each year despite differences in yearly precipitation. Wellfield study sites with at least 2 yr without surface water showed a complete loss of typical deep-water aquatic plant species such as pickerelweed (Pontederia cordata) and rush (Juncus repens). At various wellfield impacted sites, maidencane (Panicum hemitomon), willow (Salix caroliniana), blue maidencane (Amphicarpum muhlenbergianum), dog fennel (Eupatorium capillifolium) and buttonweed (Diodia virginiana) became abundant. Vegetation at the control sites was quite stable from 1 yr to the next. (Author's abstract)
W86-00899

7. RESOURCES DATA

7A. Network Design

AUTOMATIC WATER QUALITY MONITORING IN RIVERS EXPOSED TO INJURIOUS ACTIVITIES,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5A.
W86-00671

GENERAL LAKE WATER QUALITY INDEX,
National Board of Waters, Helsinki (Finland). Water Research Inst.
For primary bibliographic entry see Field 2H.
W86-00673

DENSITY OF PRECIPITATION CHEMISTRY NETWORKS,
Kozponti Cegkorfizikai Intezet, Budapest (Hungary).
L. Haszpra.
Environmental Monitoring and Assessment, Vol. 5, No. 2, p 185-197, June, 1985. 4 Fig, 2 Tab, 13 Ref, 1 Append.

Descriptors: *Precipitation chemistry, *Density, *Network design, Sulfates, Nitrates, Ammonium, Calcium, Water pollution sources, Mathematical models, Statistical models.

Using a mathematical-statistical method the accuracy of the precipitation chemistry networks of different densities were studied. The necessary density of the networks was estimated. The basic principle of network planning methods is the following: the meteorological network covering a given area has to make it possible to determine the value of the meteorological element for any point or any part of the area with the required accuracy. The error of the interpolation for any point or that of the areal averaging for any part of the area must not exceed the maximum value permitted by the investigations. Using Scandinavian precipitation chemistry data the dependence of the accuracy of the interpolation and areal averaging of sulfate, nitrate, ammonium ion and calcium ion contents of precipitation water on the density of the network and on the size of the area considered is studied. The density of networks operation with a given accuracy can be determined as a function of the area. As an example the density of the networks determining the annual and mothly areal SO4(-2) deposition as well as the point values of the monthly SO4(-2) concentration with an accuracy of 1%, 25% and 30%, respectively is calculated. The accuracy provided by such networks for other components in precipitation water is also studied. (Baker-IVI)
W86-00684

ENVIRONMENTAL AUDIT. II. APPLICATION TO STREAM NETWORK DESIGN,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
J. A. Perry, D. J. Schaeffer, H. W. Kerster, and E. E. Herricks.
Environmental Management, Vol. 9, No. 3, p 199-207, May, 1985. 5 Tab, 22 Ref.

Descriptors: *Environmental audit, *Network design, *Streams, Idaho, Sampling, Data acquisition, Data interpretation, Water quality, Decision making, Monitoring, Planning, Management.

The planning and execution of water quality management programs requires careful collection and analysis of data coupled with a systematic review and analysis of programmatic success. The environmental audit is a tool which facilitates improved water quality planning and management. This article demonstrates the utility of the environmental audit by reviewing portions of a comprehensive review of the water quality management program for the state of Idaho. The audit is a tool which forces careful design of a sampling program before data are collected. In the audit approach, program objectives are clearly stated prior to initiation of sampling. Stated objectives are also evaluated regularly to identify tension points, that is, conflicts between expectations and reality. In the example taken from Idaho, a management review team followed a directive to redesign the water quality monitoring program. A summary of the redesign as proposed by that team is presented to illustrate the results of a typical review of monitoring programs. That summary is followed by an example of how the proposed program would differ if the audit approach had been used. The two approaches offered both coincident and conflicting recommendations. Management review team and audit recommendations for lake sampling programs were similar even though a different process was used to develop the recommendatons. The most striking contrast between the two results lies in the review team's approach to the problem. The directives followed, and the team's responses, concentrate on tools, such as increasing biological monitoring or reliance on monthly BWMP stations. In contrast, the audit results stress addressing management questions for which clear objectives have been stated, depending on specific tools only as needed to meet stated objectives. Although the audit does integrate externalities in its structure, it is little affected by economic or political influences. A major strength of the audit approach is its ability to provide defensible data for management decision making. (Author's abstract)
W86-00723

7B. Data Acquisition

DETERMINATION OF MOISTURE IN SOLIDS,
Lawrence Livermore National Lab., CA.
For primary bibliographic entry see Field 2G.
W86-00644

SURFACE SOIL WATER CONTENT MEASUREMENT USING PULSED NUCLEAR MAGNETIC RESONANCE TECHNIQUES,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
For primary bibliographic entry see Field 2G.
W86-00698

USE OF SEEPAGE METERS TO ESTIMATE GROUNDWATER NUTRIENT LOADING TO LAKES,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Sciences and Engineering.
T. V. Belanger, and D. F. Mikutel.
Water Resources Bulletin, Vol. 21, No. 2, p 265-272, April, 1985. 3 Fig, 6 Tab, 22 Ref.

Descriptors: *Seepage meters, *Nutrients, *Lakes, *Seepage, Groundwater movement, Nitrogen, Phosphorus, Lake sediments, East Lake Tohopekaliga, Florida.

Data from a study on East Lake Tohop Florida, indicate that the seepage meter m ment method may often overestimate nutri tributions to lakes. Nutrient loading data f method and a method employing lakeside p ter nutrient data and seepage meter flows v comparable. Seepage nutrient loading fr meter and piezometer methods comprised 18% of the nitrogen budget and 38 and 9% phosphorus budget, respectively, for Ea Tohopekaliga. In terms of water, grou seepage accounted for only 14% of the to to the lake. It is felt that some of the pas using the seepage meter method to estima ent loading may be in error due to reasons to the enclosure of lake sediments by the m the accompanying anaerobic conditions quickly result. (Author's abstract)
W86-00788

REMOTE DETECTION OF GROUND CONTAMINANTS USING FAR-ULTRAV LASER-INDUCED FLUORESCENCE,
Tufts Univ., Medford, MA. Dept. of Civ neering.
W. A. Chudyk, M. M. Carrabba, and J. E. Analytical Chemistry, Vol. 57, No. 7, p 12 June, 1985. 6 Fig, 2 Tab, 16 Ref. NSF gran 8114621.

Descriptors: *Groundwater contam *Remote sensing, *Fluorescence, *Pollutan fication, Phenol, Cresol, Toluene, Chlor Nitrophenols, Xylenes, Detection limits, acids.

Remote fluorescence analysis of groundwa taminants by using UV lasers and fibers op successfully tested. Several priority p (phenol, o-cresol, toluene, o-chlorophenol, phenol, 2,4-dinitrophenol, and xylenes) as naturally occurring humic acid, at environ significant concentrations, were readily by using the technique. At an instrument distance of 25 m, which equals or exce depth of many aquifers used as drinki supplies, individual compounds had d limits at or below the parts per billion lev nolic and humic acid contaminants in actu fill and barkpile leachates were easily det 25 m after 10,000-fold dilution. Practical p in implementing a UV-laser-based system, efficient coupling, fiber damage thresh proximately 15 MW/sq cm), scattered ligh of response curve, etc., have been exami simple solutions demonstrated. (Author's W86-00818

MICROARRAY ELECTROCHEMICAL DETECTORS AT HIGH APPLIED TIALS AND LIQUID CHROMATOG WITH ELECTROCHEMICAL DETECTI CARBAMATE PESTICIDES IN RIVER W
Georgia Univ., Athens. Dept. of Chemistry
J. L. Anderson, K. K. Whiten, J. D. Brews Y. Ou, and W. K. Nonidez.
Analytical Chemistry, Vol. 57, No. 7, p 13 June, 1985. 6 Fig, 3 Tab, 47 Ref.

Descriptors: *Electrochemical flow d *Liquid chromatography, *Carbamates, cides, Chromatography, Microarray ele Solid electrodes, Kelgraf, Pesticides, C analysis.

The properties and advantages of microar trodes are discussed relative to solid elect flow detectors. Amperometric response fo of Kelgraf microarray electrodes of vary cent graphite is in agreement with theoret dictions. The Kelgraf electrode effectiv criminates between oxidation reactions lir the rate of mass transport and reactions (i solvent oxidation) limited by the rate of transfer or other surface processes, affor proved detection limits at high applied po The advantages are illustrated for measure carbamate pesticides spiked into a rive matrix, using liquid chromatography with chemical detection. Subnanogram detecti

50-430-pg range) are obtained in all cases inimal sample cleanup or pretreatment, with h as 60-fold improvement over other reports sy carbon or alternative LC detectors in the ses. The relative magnitudes of pesticide response at Kelgraf and glassy carbon elec- under identical conditions are consistent eoretical predictions, while enhancements signal/noise ratio are slightly lower than d. (Author's abstract)
$20

valuation, Processing and cation

APHIC INFORMATION SYSTEMS ATURAL RESOURCE MANAGEMENT,
a State Univ., Stillwater. Center for Ap- s of Remote Sensing.
ish.
of Soil and Water Conservation, Vol. 40, 202-205, March/April, 1985. 4 Fig, 10

ors: *Water management, *Maps, *Re- development, Remote sensing, Planning, Model studies, Data processing.

ty to turn analog information into digital then to edit, store, and display the data as color images has a variety of applications ce management and regional planning. planners, engineers, agriculturalists, and ers use maps or images displaying soil ogy, land use, hydrology, and other nat- rce data on a daily basis. The advantages ng these data in a geographic information clude ease of retrieval, variety of output o fit almost any need, and the ability to nd display information gained by testing ctions between natural resources phe- d to organize and appraise variable coef- r predictive models. A need exists to unoff as a function of soil, vegetation, dent moisture and to simulate physically ents on the natural system on a temporal basis. Organizing data in a geographic n system permits the appraisal of non- tion over extensive areas and on a repet- dule. Such a system also provides a for identifying and managing areas that in relative amounts to the runoff prob- -IVI)

INEERING WORKS

uctures

THE ART ON THE DIMENSION- ILLWAYS FOR DAMS, APPENDIX: JET SPILLWAYS (ETAT DES CON- ES SUR LE DIMENSIONNEMENT CUATEURS DE CRUE DES BAR- NNEXE: EVACUATEURS A JETS

to, Lisbon (Portugal).
:.
che, No. 1, p 19-52, 1985. 19 Fig, 3

*Spillways, *Design criteria, spillways, Turbulent flow, Energy cour, Hydraulic design, Intakes.

is given of the state-of-the-art on the of spillways, having in mind their d analyzing : the intake components; ream of the intake as far as the energy he dynamics of the jets; turbulent ined stilling basins; the scour process. eoretical and experimental study is effect of the shock between the de- of the surface spillways and the as- of the bottom jets - crossed jets - presented that make it possible to eduction in the scour potential of the ge. (Author's abstract)

W86-00655

WHAT'S GOING ON UNDER CHICAGO,
De Leuw, Cather and Co., Chicago, IL.
E. McGuire.
Pollution Engineering, Vol. 17, No. 2, p 29-32, February 1985. 2 Fig.

Descriptors: *Chicago, *Calumet Pumping Station, *Illinois, *Tunnels, *Pumping stations, Pumps, Sewers, Main sewers, Wastewater facilities, Water transport.

The Calumet Pumping Station, a part of the Chicago (Illinois) Tunnel and Reservoir Plan (TARP), uses six computer-controlled centrifugal pumps with a combined capacity of 280,000 gallons per minute (gpm) to deliver wastewater at a suction head varying from +5 to -322 ft Chicago City Datum. Unlike a conventional lift station, the Calumet Pumping Station, which will go on line in early 1985, will discharge directly into the sewage treatment works, and has been designed to function on flow demand rather then maintenance of a wet shaft water level. The system includes two pump rooms, located 350 ft below grade, interconnecting shafts and an electric substation, and various above-ground support facilities. The pumps selected include two types: four with infinitely variable-speed transmissions coupled to 6,000 horsepower (hp) synchronous motors, with rotation speeds from 0-600 revolutions per minute, and two constant-speed units driven by 2,500 hp induction motors. The control system allows operation automatically from a remote control room, manually from the same control room, or locally from control panels located adjacent to the equipment being controlled. Six ultrasonic flow meters provide continuous flow measurements to computers, which govern the system and record 44 separate functions, each of which can be assigned to trend recorders for analysis as part of the preventive maintenance program. Quick-closing valves (84 inches in diameter) are provided for security against flooding of the pump room, and fire, hazardous gas, and oxygen deficiency are monitored, with automatic responses to an emergency programmed into the controls of support systems. Trash removal is by bar screens, screen rakes, and skip hoists, with disposal off site. A 16-foot diameter equipment shaft is provided for each pump room, with a 40-ton capacity overhead crane for moving equipment. (Rochester-IVI)
W86-00767

LARGE-DIAMETER FLEXIBLE STEEL PIPES FOR THE TRANSFER WORKS OF THE KIELDER WATER SCHEME,
Babtie, Shaw and Morton, Glasgow (Scotland).
For primary bibliographic entry see Field 8G.
W86-00832

SUPERHYDRO,
A. Danilevsky.
Civil Engineering, Vol. 54, No. 11, p 54-57, November, 1984. 1 Fig.

Descriptors: *Hydroelectric plants, *Pumped storage, *Dams, *Bath County, *Virginia, Reservoirs, Tunnels, Electric power production.

When the Bath County (Virginia) Pumped Storage Project is completed in 1986, it will be the world's largest, with six turbine/pump generator/motor units rated at 2,100 Mw. Bath County is in the James River basin, high in the ridges and valley of the Appalachian Mountains. Conduits in rock connect the upper lake to the lower one with a drop of about 1,200 ft from the upper lake to powerhouse over a more than 8,000 ft route. Two dams are involved, both of earthfill/rockfill type with impervious cores. The upper dam is 460 ft high and 2,200 ft long; the lower dam is 150 ft high and had a spillway designed to carry 38,000 cu ft/sec. The reinforced concrete powerhouse is designed to resist being submerged to 6 ft above its roofline, with only the parapet protecting it from flooding. The main generator hall contains six bays, each with a reversible turbine/pump connected to a reversible generator/motor unit. Each unit has a rated 3,350 Mw generating capacity at a rated 1,262 ft head and required 410 Mw when reversed. A 500 kv switchyard is on the roof deck, and nine 300 Mva transformers are upstream in the powerhouse yard. Three 28.5 ft diameter tunnels lined with 18 in concrete will be used to connect the upper and lower reservoirs. A 986-ft vertical shaft about midway along the tunnel accounts for most of the vertical drop to save excavation costs. Surge chambers, located just upstream from the vertical shafts, are 330 ft high and 44 ft in diameter. (Rochester-IVI)
W86-00883

ITAIPU, SOUTH AMERICA'S GRANDE DAME,
Itaipu Binacional, Rio de Janeiro (Brazil).
J. R. Cotrim, H. W. Krauch, and G. S. Sarkaria.
Civil Engineering, Vol. 54, No. 12, p 40-43, December, 1984. 2 Fig.

Descriptors: *Itaipu, *Brazil, *Paraguay, *Parana River, *Hydroelectric plants, *Hollow dams, Costs, Dam construction, Construction costs, Dams.

The world's highest and largest hollow gravity dam was built at Itaipu, on the Parana River between Brazil and Paraguay. The structure is 643 ft high and 25,400 ft long. Key elements in the success of the project were timely diversion of the river through a single diversion channel, which prevented an 8-mo delay in construction that would have cost $300 million in interest charges, construction of suitable cofferdams of 295 ft and 246 ft high, and maintenance of minimum flow as the reservoir filled. The selection of the hollow gravity design saved 2.1 million cubic yards of concrete compared to a solid gravity design. An unexpected combination of flooding conditions necessitated changes in the planned filling procedure; all 14 spillway gates, each 65.6 x 70 ft, were opened 15 days after storage began. The Itaipu spillway will be required to operate continuously until more power units can be installed. The maximum spillway discharge so far has been 1,348,000 cu ft/sec, 61% of the design capacity. Two 700 Mw generating units became operational in 1984; all 18 units will be operational in 1990 when the project capacity will be 12,000 Mw. The Itaipu project, when completed, is estimated to cost $15 billion (1983 dollars), of which about 36% is for interest and financial charges. The system will operate as a base-load power plant with very little drawdown, which will ensure high operational efficiency and low maintenance costs. (Rochester-IVI)
W86-00886

PROPORTIONAL WEIRS FOR STORMWATER POND OUTLETS,
EGC-Southwell, Inc., Englewood, CO.
A. Sandvik.
Civil Engineering, Vol. 55, No. 3, p 54-56, March, 1985. 4 Fig.

Descriptors: *Weirs, *Proportional weirs, *Storm runoff, *Detention reservoirs, Construction, Costs, Flood protection, Dams.

A proportional weir to control outflow from a stormwater pond near Denver, Colorado, provides a way to restrict floodwater release from a developed site to historic flows, thus preventing downstream property damage and resulting legal claims. The proportional weir uses an outlet that decreases in width towards its top, with cross-sectional dimensions adjusted so that there is a linear relationship between head and discharge. The weir was sized based on the maximum head available in the pond and the maximum discharge that the weir was allowed to pass (100-yr historic). The approximate maximum storage volume for the stormwater pond was found by determining the areas between the historic and post-development storm hydrographs. The proportional weir outlet structure was constructed of reinforced concrete, with each side supported by a counterfort extending perpendicular to the weir in the upstream direction. The weir edge was constructed by bending two steel channel sections to the dimensions outlining the weir.

An energy dissipator consisting of 18-24-in riprap was placed immediately downstream, depressed 4 ft. In 1982, the weir cost $43,000, with an additional $118,000 required for a flashboard dam. Cost of grading the detention pond was additional. (Rochester-IVI)
W86-00887

HYDRAULIC FILL DAM MADE EARTHQUAKE RESISTANT,
East Bay Municipal Utility District, Oakland, CA.
H. J. Billings.
Civil Engineering, Vol. 55, No. 6, p 56-59, June, 1985. 4 Fig.

Descriptors: *Hydraulic-fill dams, *Earthquake engineering, *San Pablo, *California, Dams, Geologic faults, Construction criteria, Buttress dams.

An earthfill buttress, combined with a sand (drain) blanket, was used to protect the dam at the San Pablo (California) reservoir from the potential effects of earthquakes. The dam, built in 1919-21 by hydraulic fill methods, lies relatively close to the active Hayward, Calaveras, and San Andreas faults. Of 20 originally studied construction alternatives, seven were considered feasible: an upstream rockfill buttress, a new dam at one of three locations, an upstream earthfill buttress, a replacement of the existing dam, and a partial replacement of the existing dam. The upstream fill buttress was not only the most economical, but was most desirable from engineering and environmental viewpoints. To install the 50-60 ft-thick buttress, the reservoir had to be dewatered. Water supply was ensured by constructing a temporary pumping plant and a temporary pipeline running along the reservoir shoreline and into the raw water line below the reservoir. The discovery that porewater pressures equal to 100% of the amount required for liquefaction could occur during an earthquake both within the dam and within the impervious buttress necessitated installation of drains. A 3 ft-thick sand blanket was installed, complete with three new vertical vents, between the dam and the new buttress, to ensure that pore pressures would be released into the reservoir. Vertical sand drains were also drilled within the original dam cross-section. The project cost $16.4 million, of which $3.3 million was for the bypass waterway system. (Rochester-IVI)
W86-00888

8B. Hydraulics

MODELLING VIBRATION AND VORTEX FORMATION AT PIEDRA DEL AGUILA,
Ecole Polytechnique Federale de Lausanne (Switzerland). Lab. d'Hydraulique.
J. Bruschin.
International Water Power and Dam Construction, Vol. 37, No. 5, p 21-24, May, 1985. 9 Fig, 4 Ref.

Descriptors: *Vibrations, *Vortices, *Piedra del Aguila, *Dams, Service gates, Cavitation, Spills.

Model tests were used to successfully define and correct vibration and vortex formation problems associated with the Piedra del Aguila dam. The Piedra spillway uses 15 x 18.5 m radial gates and 3 x 2 m maintenance and service gates at the bottom outlet. Runs with the spillway on the general 1:130 model demonstrated active, partly air-entraining, vortices in the inlet bays upstream from the spillway crest. Observations were conducted and vortices were ranked in terms of strength, size, and persistency, scale effects were estimated, and vortex-suppressing measures were proposed and tested. Modification of bay or pier shape was eliminated as a potential solution after testing, but vortex-suppressing collars around the pier heads efficiently suppressed the vortices. A boundary layer suction device also was designed and tested. Testing at scale 1:25 showed that the device worked smoothly if well submerged, even under rather high heads. Systematic tests were conducted with the service gate opened at 31.49% and 77% of the total aperture while the maintenance gate was progressively lowered, because this operational procedure seemed most likely to uncover vibration and cavitation risks according to the results of earlier tests. Large sub-atmospheric pressures with important fluctuations (standard deviation = 1/3 of the average pressure value) were found between the two gates. It was observed, however, that a very small displacement of the maintance gate produced an abrupt change in the pressure pattern, so this condition was discarded from the list of high-risk situations being considered. (Rochester-IVI)
W86-00800

SIMPLE GOVERNING AND SURGING SIMULATION, PART ONE,
Queen's Univ., Kingston (Ontario). Dept. of Mechanical Engineering.
R. A. Chaplin.
International Water Power and Dam Construction, p 25-28, May, 1985. 2 Fig.

Descriptors: *Surges, *Governing stability, *Turbines, *Simulation, Mathematical equations, Hydroelectric plants, Hydraulic transients, Computers.

This article considers the governing stability of hydro turbines and the hydraulic transients in waterways following various changes in operating conditions. The appropriate mathematical equations are derived to give the necessary background for an overall understanding of the formulation of the expressions and physical phenomena. The equations are then put together to create a simple but effective method of determining the overall transients occurring in hydro powerplant following a disturbance. The resultant computer program (to be published in Part Two) can be used on any desk top computer to study various elementary transients. The emphasis is on simplicity since the program lends itself by expansion, to reasonable degree of elaboration. (Author's abstract)
W86-00801

8C. Hydraulic Machinery

HYDRO-PLANT UPGRADES YIELD RELIABLE, COST-EFFECTIVE KILOWATTS,
J. Makansi.
Power, Vol. 129, No. 5, p 61-63, May. 1985. 6 Ref.

Descriptors: *Hydroelectric plants, *Costs, *Upgrading, Capacity, Power plants, Turbines, Generators, Maintenance.

Older hydroelectric plants often have additional capacity available if steps are taken to upgrade equipment to the best modern standards. Efficiency of turbine runners may be improved by replacing carbon steel runners with those made of stainless steel (integrally cast). Uprating of a turbine/generator usually means more water flow through the unit, which generates a requirement for upgrading of other elements, such as wicket gates, seals, and operating procedures intended to balance runner cavitation, output, and minimum tailwater elevation. The Electric Power Research Institute and others recommend that generator stator windings be subjected to a comprehensive program of dielectric measurements, supplemented by visual inspections at regular intervals, so that trends in performance and condition can be used to predict when rewinding is necessary. Uprating a turbine/generator may necessitate improving of coupling bolts, rotor hubs, spider assemblies, and shafts because these components may be subjected to greater stresses and thermal loads. The thrust bearing load should also be examined when upgrading a system. Modern instrumentation provides many more measurements than are normally offered with older systems. (Rochester-IVI)
W86-00804

EVALUATING PUMP CHARACTERISTICS IN DEVELOPING COUNTRIES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. Briscoe.
Civil Engineering, Vol. 54, No. 11, p 58-61, November, 1984. 1 Tab, 7 Ref.

Descriptors: *Pumps, *Developing, *Evaluation, Pump testing, Performa, tion, Training, Algorithm.

Using theoretical considerations, forr veloped to relate pump parameters (eg per minute, impeller diameter, and di diameter) to pump performance ch (flow and head), and the results were a table. Pump types included in th manual reciprocating, motor-driven r simple centrifugal, multistage pump turbine pumps for boreholes), helical hole pumps, and hydraulic rams. Forr culating electric and diesel motor size ed also. For each type of pump in example calculation is worked using formation, with each step in the calcul ed. The table should be useful to personnel in developing countries wh rience with the approximations and l volved in this type of performance es water technician training, the approa can be adapted to the types of pu particular regions. (Rochester-IVI)
W86-00884

8E. Rock Mechanics and Geology

SEISMIC MICROACTIVITY AN LEVEL VARIATION IN INDUSTI NEAR FLORENCE (ITALY),
Florence Univ. (Italy). Ist. di Geologi logia.
For primary bibliographic entry see F
W86-00632

HYDROGEOLOGICAL PR GROUP AND TYPES OF MINERA FILLED WITH KARST WATER IN CHINESE).
For primary bibliographic entry see F
W86-00897

8G. Materials

LARGE-DIAMETER FLEXIBLE S FOR THE TRANSFER WORKS KIELDER WATER SCHEME,
Babtie, Shaw and Morton, Glasgo
N. S. M. Berry, F. M. Forsyth, and J.
Journal of the Institution of Water I Scientist, Vol. 39, No. 2, p 113-133, A Fig, 2 Tab, 12 Ref.

Descriptors: *Pipelines, *Kielder W *England, Pipes, Conveyance stru struction methods, Construction ma Stress, Materials testing.

A large-diameter pipe was selected for the pumping main (2,020 mm out and aqueducts crossing the Wear Valleys (2,890 mm inside diameter) a to transfer water as part of a flow scheme for the River Tees (northeast Design requirements included the abi at either 'normal' pumping level (546 day) or 'abnormal' pumping level liters/day). In addition to hydrau pipes were chosen to withstand har effects of both transverse and radial which could act on the buried pipe tion and stress measurements were finished sections. Installation had to count the problem of possible floatin pipe as it crossed floodplains at belo Spirally-welded steel pipe was the choice of material; 43A and 50B ste and a special joint, the Babtie/By designed for this pipeline. Ultimately given a cement mortar lining, whi entirely placed by machine because tention to pipe joint details. Trench precompacted, and graded crushed was used to achieve suitable suppo

one of the local materials was suitable for
he excavation. Movement of machinery
e pipe was controlled, although there
aches of the rules, which did cause pipe
s. There was reasonable agreement be-
ld measurements and theoretical predic-
exible pipe design method. The maximum
stress was some 40% of the yield stress of
Deviation of the pipe was limited to +
lo enable cement mortar lining. Conse-
ne buckling limit of the pipe is not likely
ned; the minimum factor of safety against
s 3. Some pipes were pre-deflected prior
ion. This approach was useful in limiting
eccentricity of the buried flexible pipes,
ing of props caused some problems.
-IVI)
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8I. Fisheries Engineering

DISTRIBUTION PATTERN OF DENITRIFYING BACTERIA IN FISH PONDS OF DIFFERING FARMING MANAGEMENTS,
Kalyani Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-00622

FRESHWATER AQUACULTURE IN CHINA: ECOSYSTEM MANAGEMENT FOR SURVIVAL,
New Alchemy Inst., East Falmouth, MA.
For primary bibliographic entry see Field 2H.
W86-00664

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Finnish Game and Fisheries Research Inst., Helsinki. Fisheries Div.
For primary bibliographic entry see Field 2H.
W86-00678

POLLUTION LOADINGS FROM FINNISH INLAND FISH-FARMS: A CASE STUDY,
Kuopio Univ. (Finland). Dept. of Occupational and Industrial Hygiene.
For primary bibliographic entry see Field 5B.
W86-00680

SEPARATING STARVATION LOSSES FROM OTHER EARLY FEEDING FRY MORTALITY IN STEELHEAD TROUT SALMO GAIRDNERI, CHINOOK SALMON ONCORHYNCHUS TSHAWYTSCHA, AND LAKE TROUT SALVELINUS NAMAYCUSH,
New York State Dept. of Environmental Conservation, Albany. Bureau of Environmental Protection.
For primary bibliographic entry see Field 5C.
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VOLUME 19, NUMBER 4
APRIL 1986

86-01319
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A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 19, NUMBER 4
APRIL 1986

W86-00920 -- W86-01319

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpira Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimenta Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impa Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agricul

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Wa Man's Nonwater Activities; Watershed Protection.

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SELECTED WATER RESOURCES ABSTRACTS

TER CYCLE

neral

ED STORE OF SOLUBLE SALTS IN E EYRE CATCHMENT IN QUEENS-ID THEIR POSSIBLE TRANSPORT MFLOW TO THE LAKE,
ealth Scientific and Industrial Research on, Canberra (Australia). Div. of Water esources.
, and P. M. Fleming.
Journal of Soil Research, Vol. 22, No. , 1984. 3 Fig, 6 Tab, 35 Ref.

: *Lake Eyre catchment, *Queensland, te transport, Weathering, Soils, Model tial distribution, Rocks, Sodium, Chlo-es, Ammonium, Bicarbonates, Calcium, sum, Lakes.

ata from 145 samples of deeply weath-weathered rocks and 35 soil samples is for a first approximation estimate of soluble salts in the Lake Eyre catch-g about 500,000 sq km in Queensland. ndscape model is defined to estimate stribution of the soluble chemical con-the various rocks and soils. The esti-ties of soluble sodium and chloride in t at 14 x 10 to the 9th power and 25 x inth power tons respectively. Some ocks also contain appreciable nitrate m ions. Available data indicate that sodium and calcium are the dominant m flood flows, whereas halite and he dominant salts in the lake. Precipi-onstitution of degraded clays in the ad may account for the absence of the lake. It is concluded that the d unweathered Cretaceous sedimen-the catchment contain large stores of and are the most likely sources of the alts in the lake. (Author's abstract)

R FOR WATER RESOURCES IN INS,
Research Service, Temple, TX.
, A. D. Nicks, and J. G. Arnold.
draulic Engineering, Vol. 111, No. 6, ne, 1985. 2 Tab, 11 Ref, 1 Append.

Simulation, *Rural basins, *Hydro-*Computers Water yield, Sediment r, Hydrology, Sedimentation, Reser-Runoff, Flood routing, Model studies, rainage basins.

ed SWRRB (Simulator for Water Rural Basins) was developed for sim-ogic and related processes in rural ective in model development was to fect of management decisions on ment yields with reasonable accura-rural basins throughout the United ree major components of SWRRB ydrology, and sedimentation. Proc-d include surface runoff, percola-ow, evapotranspiration, pond and ge, and sedimentation. The SWRRB eloped by modifying the CREAMS noff, and Erosion from Agricultural Systems) daily rainfall hydrology lication to large, complex, rural or changes were: (1) A return flow added; (2) the model was expand-ultaneous computations on several a reservoir storage component was n determining the effects of farm r reservoirs on water and sediment ather simulation model (precipita-tion, and temperature) was added longer-term simulations and more eather inputs, both temporally and better method was developed for peak runoff rate; and (6) a simple component was added. Besides also simulates sediment yield using Universal Soil Loss Equation (MUSLE) and a sediment routing model. Tests with data from a 538 sq km basin in Oklahoma and a 17.7 sq km basin in Texas indicate that SWRRB is capable of simulating water and sediment yield realistically. (Author's abstract)
W86-01049

CONTINUOUS CONVOLUTION WITH HYDROLOGIC DATA,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
T. G. Chapman.
Water Resources Research, Vol. 21, No. 6, p 847-852, June, 1985. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Hydrologic data, *Convolution equation, Sampling, Algorithms, Mathematical equations, Deconvolution.

The integral form of the convolution equation can be used for hydrologic data sampled at equal time increments of simple functional forms are assumed for the change in the hydrologic variables between sampling points. The forms studied here are a step function, linear segment, and sliding polynomial, and algorithms are presented for convolution of all combinations of these functions. The effect of the different assumptions is demonstrated by a sample data set. These algorithms have three advantages: an appropriate functional form can be selected for the two variables to be convolved, different time increments may be use for the two variables, and the output may be calculated at any point in continuous time, not just at multiples of the sampling increments. The algorithms may also be applied to deconvolution but suffer many of the difficulties of matrix inversion techniques when the data contain errors or are derived from a system which is only approximately linear. (Author's abstract)
W86-01076

STOCHASTIC MODELS APPLIED TO EVALUATING HYDROLOGIC CHANGES,
National Council for Scientific Research, Lusaka (Zambia). Water Resources Research Unit.
T. C. Sharma.
Journal of Hydrology, Vol. 78, No. 1/2, p 61-81, May, 1985. 6 Fig, 6 Ref, 13 Ref.

Descriptors: *Model studies, *Hydrologic models, *Kafue River basin, *Zambia, *Rainfall-runoff relationships, Runoff, Temporal distribution, History, Discharge.

Simple statistical tests for equality of means and variances, and Box-Jenkins univariate and input-output models were applied to the Kafue River Basin, Zambia, to detect hydrologic changes. The structural decomposition of monthly runoff series into periodic and stochastic components, and the step response function of monthly runoff processes in relation to monthly rainfall processes provide parameters that form a basis for evaluating the changes in the hydrologic environments. The hydrologic changes were found to be reflecting changes of the model parameters in the following manner: (1) The steady-state or the equilibrium value for the rainfall-runoff step response function rose after the mid-1930's, suggesting that the potential of the basin increased for generating the runoff water. (2) The time constant (months) for the monthly rainfall-runoff system increased after the mid-1930's, suggesting that the transmission capability of the system for transporting the generated runoff tended to slow down during the same period. (3) The role of the stochastic component in influencing the monthly runoff process grew after the mid-1930's. The stochastic component behaved as a Markov or AR(1) process before the mid 1930's, while the behavior of the stochastic component resembled an ARMA(1,1) process after that. (4) The levels of yearly and monthly runoff depths (discharges), yearly maximum daily discharges and yearly minimum daily discharges underwent a general rise after the mid-1930's. (Author's abstract)
W86-01293

2B. Precipitation

STATISTICAL-METEOROLOGICAL EVALUATION OF TWO OPERATIONAL SEEDING PROJECTS,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 3B.
W86-01136

HIGHEST OBSERVED 1 TO 10-DAY POINT AND AREAL RAINFALL OVER KERALA STATE,
Indian Inst. of Tropical Meteorology, Poona.
S. A. Saseendran, P. R. Rakhecha, and O. N. Dhar.
Indian Journal of Power and River Valley Development, Vol. 33, No. 12, p 438-443, December, 1983. 10 Fig, 4 Tab, 5 Ref.

Descriptors: *Rainfall, *Kerala, *India, Rainfall area, Rainfall distribution, Altitude.

Daily rainfall data of about 100 stations in and around Kerala State (India) for a period of 70 years from 1901-1970 have been analyzed to determine the the highest rainfall amounts for 1 to 10-day durations. Using the highest rainfall data at each of 100 stations a family of generalized highest rainfall charts of 1 to 10-day durations were prepared. The highest 1-day rainfall values range from 21 to 53 cm. Heavy falls of rain of 40 cm or more in one day are confined to areas close to the Western Ghats on their windward sides. The 2-day highest rainfall varies from 31-85 cm. The highest point rainfall values for 10-day rainfall ranged from 62-243 cm. A common feature revealed by all the maps is that high rainfall values occur over and near the Western Ghats and isolines of rainfall almost run parallel to the contour lines. Vayittiri station recorded the highest rainfall amounts for all 10 durations. At the rainiest stations about 30% of the maximum rainfall in a 10-day duration is recorded in one day and about 40-50% in 2 day duration. (Moore-IVI)
W86-01223

RECENT CHANGES IN SUMMER RAINFALL VALUES MEASURED AT LONG ASHTON,
Bristol Weather Center (England).
M. R. Woodley.
Weather, Vol. 40, No. 6, p 180-183, June, 1985. 5 Fig, 1 Tab.

Descriptors: *Seasonal variation, *Rainfall, *England, *Long Ashton, Drought, Water supply.

Changes in summer rainfall amounts in one part of the south-west of England are documented. Differences between the 1984 dry spell and the one in 1975-76 are also noted. Analysis of annual rainfall totals considered as a 25 year running mean shows an irregular decline from 1944 until 1979, after which all but one of the following years had above average rainfall. Even so, over the period as a whole, this represents a decline of about 52 mm in average annual values, using linear regression. For the period 1972-78 when the rate of change was at its greatest, the decrease was significant at the one percent level. A decrease in rainfall is noted in the mid-1970s, with its nadir in August 1976, and another very low point in November 1978. Thereafter, monthly rainfall amounts were frequently above average so that the cumulative difference from the 30-year average had returned to near zero by January 1983. Seasonal rainfall for the summer months shows an altogether different pattern. During 1971-84 there were four very dry summers and only one very wet summer. In the 13 year period from 1979-84 there were only three summers with above average rainfall. Put against the changes in annual rainfall values it becomes clear that the present dry spells are set against above-average rainfall in the preceding four or five years, whereas the drought of the mid-1970s was part of a continuing decline in annual rainfall. (Baker-IVI)
W86-01303

2C. Snow, Ice, and Frost

MACHINE CLASSIFICATION OF FRESHWATER ICE TYPES FROM LANDSAT-1 DIGITAL DATA USING ICE ALBEDOS AS TRAINING SETS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
G. A. Leshkevich.
Remote Sensing of Environment, Vol. 17, No. 3, p 251-263, June, 1985. 5 Fig, 1 Tab, 38 Ref.

Descriptors: *Ice, *Albedo, *Landsat-1, *Remote sensing, *Green Bay, *Great Lakes, *Lake Michigan, Satellite technology, Reflectance, Lake ice.

A method has been used to convert ground-measured freshwater ice albedos to Landsat-1 digital numbers indirectly corrected for atmospheric attenuation and path radiance. The method has been tested by using the digital numbers as training sets to machine classify Landsat-1 digital ice cover data from a portion of northern Green Bay (Lake Michigan) imaged on 13 February 1975. The conversion algorithm produced digital numbers that, when used as training sets, classified approximately 50% of the test area. Differences between the classified test area and a previous machine classification of the scene, as well as the percentage of unclassified area caused by lack of data for some surface types, points to the need for a more comprehensive, well-documented library of signatures representing Great Lakes ice types. (Author's abstract)
W86-01288

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION DERIVED FROM SATELLITE OBSERVED SURFACE TEMPERATURES,
Utrecht Rijksuniversiteit (Netherlands). Inst. voor Meteorologie en Oceanografie.
W. Klaassen, and W. van Den Berg.
Journal of Climate and Applied Meteorology, Vol. 24, No. 5, p 412-424, May, 1985. 17 Fig, 1 Tab, 38 Ref.

Descriptors: *Evapotranspiration, *Satellite technology, *Remote sensing, *Soil temperature, *Surface temperatures, Energy balance method, Wind velocity, Air temperature, Model studies.

Evapotranspiration was calculated from surface temperatures using an energy balance method. This method is sensitive to the temperature difference between the surface and the air above, and somewhat to the windspeed. The influence of the spatial variability of air temperature on the interpretation of surface temperatures was considered. Small-scale atmospheric variations can be corrected by using temperature and wind data at a height of 50 m. Three models have been used to calculate these 50 m data from standard weather observations. The first model uses a very simple concept of constant temperature and wind over the test area (zero-dimensional). In the second model windspeed is also taken constant, but air temperature is evaluated from the initial vertical temperature in the atmosphere with a one-dimensional slab layer model. The third model is a two-dimensional primitive equations model in which wind velocity is calculated from the geostrophic wind and air temperature similar to model 2. A homogeneous grassland area was selected in the north of the Netherlands close to the sea. Several days in the summer of 1983 with clear skies and winds from the sea were selected. Surface temperatures were derived from the NOAA-7 satellite overpass in the early afternoon using the split-window technique. On most days an almost linear increase of both surface and air temperature is found with increasing distance to the sea. This study reveals that 1 results in an unrealistic decrease of the calculated evapotranspiration with increasing distance to the coast. Furthermore evapotranspiration is underestimated. The evapotranspiration as calculated with models 2 and 3 is almost constant in the test area and agrees well with measurement. Model 3 gave more scatter, probably due to the fact that uncalibrated wind velocities were used. For practical calculation of evapotranspiration the Priestley-Taylor parameter 'alpha' is often used. This study shows how this parameter can be derived from satellite observations of surface temperature. (Author's abstract)
W86-01135

STOMATAL RESPONSES AND WATER RELATIONS OF EUCALYPTUS PAUCIFLORA IN SUMMER ALONG AN ELEVATIONAL GRADIENT,
Innsbruck Univ. (Austria). Botanisches Inst.
C. Korner, and P. M. Cochrane.
Oecologia, Vol. 66, No. 3, p 443-455, June, 1985. 12 Fig, 8 Tab, 68 Ref.

Descriptors: *Plant physiology, *Stomata, *Eucalyptus, *Australia, *Snowy Mountains, *Leaves, *Leaf conductance, *Trees, Plant water potential, Water potentials, Altitude, Elevation, Preciptation, Evaporation, Humidity, Soil water, Water balance.

The spatial and temporal variation of leaf conductance (g) in Eucalyptus pauciflora was analyzed with respect to photon flux area density (I), temperature (T), water vapor concentration deficit (Delta w), and leaf water potential (Psi) at four different sites between 940 m and 2,040 m altitude in the Snowy Mountains of south-eastern Australia. Along this altitudinal gradient the precipitation/evaporation ratio increases from 1 to 4. The results show that gas diffusion in this tree species is primarily controlled by I and Delta w at all sites, independently of the specific soil moisture regimen. Even under dry midsummer conditions with predawn leaf water potentials of - 1 MPa at the lowest altitude, Psi had no striking effect on g. The humidity threshold for the onset of stomatal closure does not vary greatly between the study sites (12.2 + or - 1.3 Pa/kPa). The highest and lowest values observed for Psi, the osmotic potential at water saturation (from pressure/volume curves), the mean and maximum g and stomatal density, all increase with elevation. The highest (least negative) osmotic potentials were obtained at all sites in midsummer. It therefore appears that there is no osmotic adjustment to drought in the seasonal course. The maximum difference between osmotic potentials obtained at the lowest and highest sites is 0.46 MPa. In general osmotic potential varies less than has been reported for other plant species exposed to varying water regimens. This may be the consequence of the pronounced feed-forward response of the stomata to evaporative demand, which led to only moderate tissue desiccation, never exceeding the turgor loss point. E. pauciflora is a tree species with a very conservative utilization of soil water, which adjusts to drought via stomatal control of water loss, rather than via osmotic properties. These results explain previous reports of the comparatively high susceptibility of E. pauciflora to severe drought and its positive influence on the hydrological balance of mountain ecosystems in the Australian Alps. (Author's abstract)
W86-01163

2E. Streamflow and Runoff

NEGATIVE OUTFLOWS FROM MUSKINGUM FLOOD ROUTING,
Agricultural Research Service, Columbia, MO. North Central Watershed Research Unit.
A. T. Hjelmfelt, Jr.
Journal of Hydraulic Engineering, Vol. 111, No. 6, p 1010-1014, June, 1985. 15 Ref.

Descriptors: *Muskingum Flood Routing, *Flood routing, *Flood control, Floods, Mathematical equations.

The Muskingum flood routing equation was treated as a difference form of a discrete linear response function. The response function, which represents the routine of a unit impulse through the system, was investigated to determine the criterion for ensuring only positive ordinantes. Realistic inflow sequences may be routed with less severe restrictions and still have only positive outfl
criterion will depend upon the inflo
Practical application of the Muskingu
will seldom yield negative ordinates.
W86-01052

**RELATIVE ACCURACY OF LOG PE
PROCEDURES,**
Institute of Hydrology, Wallingford (E
J. R. Wallis, and E. F. Wood.
Journal of Hydraulic Engineering, Vo
p 1043-1056, July, 1985. 5 Fig, 4 T

Descriptors: *Flood frequency, *Probe
bution, *Pearson III, Algorithms, Com
tistical methods.

The performance of the U.S. Wate
Council (WRC) flood frequency proc
computer algorithm was tested and c
alternative flood frequency procedure
assumption that flood frequency fol
Pearson III probability distribution,
WRC procedures, the one that per
used a weighted log-skew coefficient
the average regional log-skew and th
skew. Using only the average regio
was essentially as good. The alterna
procedures GEV/PWM (generaliz
value/probability weighted moment
WAK/PWM (Wakeby/probability w
ments) performed significantly better
procedures provided especially poor
basins with negative skews in the log
data. Since a significant portion of fl
hibit negative skews in log-space, th
WRC procedures on such data is a
cause of concern. The WRC flood fre
cedures should not be used as a basis
ing design because significantly more
mates can be obtained by other curren
statistical procedures. (Moore-IVI)
W86-01091

**SIMILARITY SOLUTION OF
FLOW ON PERVIOUS SURFACE,**
Old Dominion Univ., Norfolk, VA. D
Engineering.
A. O. Akan.
Journal of Hydraulic Engineering, Vo
p 1057-1067, July, 1985. 5 Fig, 3 T

Descriptors: *Overland flow, *Infiltr
larity solution, Mathematical mode
soils, Flood peak.

Similarity solutions for the overland
tion problem are obtained by use of
based mathematical model. The
model is founded on the kinematic
overland flow and the Green-Ampt fo
the infiltration process. The governing
surface flow and infiltration are cou
written in terms of four physically-
mensional parameters. Constant val
parameters imply hydraulic similarity
number of different overland flow-inf
ations. An implicit finite difference
employed to solve the governing eq
similarity approach is verified by co
similarity solutions with the results of
ly sophisticated mathematical model
of Columbia sandy loam, Yolo ligh
Guelph loam. Also, a group of pe
prediction charts are developed based
lar solutions of the overland flow-infil
lem and presented to emphasize the
the similarity approach. The use of th
illustrated by a practical application se
ed in the paper. (Author's abstract)
W86-01092

**SUBDIVISION FROUDE NUMBER
Geological Survey, NSTL Station
Coast Hydroscience Center.
D. H. Schoelhamer, J. C. Peters, and
Journal of Hydraulic Engineering, Vo
p 1099-1104, July, 1985. 1 Fig, 2

ors: *Flow, *Froude number, Floods, ntrol, Mathematical equations, Water sur-

dard step method calculates one-dimen- ady state water surface profiles by iterat- the equations for energy conservation loss between adjacent cross sections. The ent and testing of a subdivision Froude vith which the flow regime in each of the jor cross-sectional subdivisions can be is described. A knowledge of the magni- ne subdivision Froude numbers improves eer's ability to identify mixed flow re- l shallow floodplain flow, both of which the assumptions of the standard step A two-dimensional analysis is probably ropriate in these circumstances. (Baker-

4

M TECHNIQUE FOR FLOOD FRE- ANALYSIS,
l Survey, Reston, VA.
omas, Jr.
Water Resources Planning and Manage- 111, No. 3, p 321-337, July, 1985. 3 Fig, Append.

s: *Flood frequency, Estimation, Fre- stribution, Frequency analysis, Flood on III distribution.

U.S. Water Resources Council (WRC) Bulletin 15 recommending that a uni- ique be used by all Federal agencies in floodflow frequencies for gaged water- uniform technique consisted of fitting ms of annual peak discharges to a Pear- III distribution using the method of he objective was to adopt a consistent or the estimation of floodflow frequen- ould be used in computing average d losses for project evaluation. In addi- stent approach was needed for defining od-hazard zones as part of the Nation- surance Program. In 1976 WRC pub- etin 17 which extended and updated but still recommended the use of the Type III' method. Since 1976, two Bulletin 17 (17A and 17B) have been hich clarify or improve on this base lo both. This paper gives a brief histor- of the development of these bulletins ivation and justification for the adop- niform technique. Special emphasis is letin 17B, the current guidelines used gencies. Specific techniques examined elopment fo regional skew, weighting nd station skew, the basis for the low- lier tests, and the basis for the adjust- uency curves using historical informa- 's abstract)

OW VARIABILITY IN THE ATES: 1931-78,
urvey, Reston, VA.
imate and Applied Meteorology, Vol. 463-471, May, 1985. 5 Fig, 3 Tab, 24

*Streamflow, *Temporal distribution, tistical analysis, Flow, Surface flow, records.

odes of spatial and temporal variation record of streamflow were defined l components. The components were om a matrix of annual streamflow 106 grid cells covering the United ears 1931-78. Five statistically signif- ents account for more than 56% of . A varimax orthogonal rotation of mponents describes regional anoma- ed in the middle Mississippi Valley, nwest, Far West, Northeast, and t Plains. Each of these patterns is an of a less well defined spatial form e unrotated solution. Temporal vari- ations in the scores of all five components closely agree with contemporaneous national and regional departure patterns in several climatic variables. (Author's abstract)
W86-01137

ESTIMATION OF DISCHARGE AND LOADS FROM THE RIVERS FLOWING INTO LITTORAL SEAS OF CHINA (IN CHINESE),
Academia Sinica, Beijing (China). Inst. of Geography.
For primary bibliographic entry see Field 2J.
W86-01167

RECOVERY OF A STREAM INVERTEBRATE COMMUNITY FROM A FLASH FLOOD IN TESUQUE CREEK, NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W86-01170

DIRECT MEASUREMENTS OF SECONDARY CURRENTS IN A MEANDERING SAND-BED RIVER,
Queen Mary Coll., London (England). Dept. of Geography and Earth Science.
C. R. Thorne, L. W. Zevenbergen, J. C. Pitlick, S. Rais, and J. B. Bradley.
Nature, Vol. 315, No. 6022, p 746-747, June, 1985. 2 Fig, 13 Ref.

Descriptors: *Meandering streams, *Unstable channels, *River beds, *Secondary currents, Water currents, Stream beds, Channel erosion, Channeling, Hydraulics.

Natural channels often adopt a meandering course. Water flow in meander bends is three-dimensional, consisting of primary velocities which are tangential to the bend, and secondary velocities, which are in the radial plane. The pattern of secondary flow strongly affects the distribution of primary velocities. This in turn affects the distribution of erosion and deposition in the bend and the way in which the channel shifts and changes shape. Measurements of primary and secondary flows in a meandering gravel-bed river show that, in addition to the widely recognized main secondary circulation driving surface water outwards and bed water inwards, there can be a small cell of reverse rotation at the outer bank. Further data have been collected in a sand-bedded river at low, intermediate and high discharges. The results confirm the existence of the main and outer bank cells but also indicate that in some bends the main cell does not extend to the inner bank. In fact, secondary flow at the inner bank of wide, shallow bends is directed radially outwards over the whole flow depth at all in-channel flows. This indicates that some models of bend flow and channel development may be significantly in error. (Author's abstract)
W86-01171

COLLECTION AND ANALYSIS OF URBAN RUNOFF DATA IN FINLAND,
National Board of Waters, Helsinki (Finland). Technical Research Office.
For primary bibliographic entry see Field 5D.
W86-01251

COVARIANCE BETWEEN SUBSAMPLE MEAN AND VARIANCE AS RELATED TO STORAGE VARIABLES,
Technical Univ. of Istanbul (Turkey). Dept. of Civil Engineering.
M. Bayazit, J. T. B. Obeysekera, and V. Yevjevich.
Journal of Hydrology, Vol. 78, No. 1/2, p 137-150, May, 1985. 9 Fig, 8 Ref.

Descriptors: *Covariance, *Hydrologic modeling, *Flow, *Statistical analysis, *Storage, Model studies, Data interpretation, Seasonal variation, Flow regulation.

The covariance between mean and variance of subsamples was conceived as a single parameter which integrates the effects of asymmetrical extremes and dependence structure on storage capacity required for seasonal flow regulation. An exact expression for this covariance for the first-order autoregressive processes was derived. The use of covariance for estimation of skewness was investigated by simulation for both independent and dependent stationary processes. This approach results in a lesser bias in estimated skewness than the moment estimator. The relationship between covariance and the storage related variables, such as range and deficit, was studied by simulation. Covariance was positively correlated with mean range and deficit for skewness smaller than 3, and negatively correlated with adjusted range. These storage related variables are influenced in different ways by the sampling fluctuations in the coefficients of skewness and serial correlation. (Author's abstract)
W86-01297

2F. Groundwater

CONTRIBUTION TO THE ANALYTICAL DESCRIPTION OF TRANSPORT PROCESSES IN THE AQUIFER AT A DIFFUSE SUBSTANCE INPUT (BEITRAG ZUR ANALYTISCHEN BESCHREIBUNG VON TRANSPORTPROZESSEN IM GRUNDWASSERLEITER BEI DIFFUSEM STOFFEINTRAG),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
For primary bibliographic entry see Field 5B.
W86-01012

RADIOCARBON DATING OF GROUNDWATER IN TERTIARY SEDIMENTS OF THE EASTERN MURRAY BASIN,
Water Resources Commission of New South Wales, Sydney (Australia).
L. W. Drury, G. E. Calf, and J. K. Dharmasiri.
Australian Journal of Soil Research, Vol. 22, No. 4, p 379-387, 1984. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Carbon radioisotopes, *Groundwater, *Murray Basin, *New South Wales, Geohydrology, Groundwater recharge, Groundwater movement, Radioactive dating.

The Tertiary sediments located in the eastern part of the Murray Basin contain one of the most important low salinity groundwater resources in New South Wales. This has been especially apparent during recent years as increasing demands on the resource are being made by irrigators and municipal water suppliers. It is therefore imperative that the hydrogeological environment in which the groundwater occurs by thoroughly understood to allow adequate management of the resource. As part of a systematic exploration of the Tertiary aquifer systems, the Australian Atomic Energy Commission, in association with the Water Resources Commission of New South Wales, carried out a radiocarbon dating project on 37 groundwater samples from bores screened in these unconsolidated sediments. The results indicate water ages in the ranges 'modern' to 15,800 years. Groundwater recharge areas are indicated and rates of groundwater recharge and movement determined. The latter shows close correlation with velocity values quantitatively determined by Darcy's law. (Author's abstract)
W86-01036

UNSATURATED AND SATURATED FLOW THROUGH A THIN POROUS LAYER ON A HILLSLOPE,
Western Australia Univ., Nedlands. Dept. of Mathematics.
D. G. Hurley, and G. Pantelis.
Water Resources Research, Vol. 21, No. 6, p 821-824, June, 1985. 3 Fig, 10 Ref.

Descriptors: *Unsaturated flow, *Saturated flow, *Storm seepage, *Slopes, Porous media, Infiltration, Kinematic wave theory, Water table, Mathematical equations, Hills.

The subsurface stormflow in a layer of porous earth overlying an impervious hill is investigated in

the case when the thickness of the layer is small compared to a typical hill dimension. If the infiltration rate at the surface is low and varies slowly with time, the head is approximately constant along normals to the hillslope, and the flow in both the saturated and unsaturated regions is described by a simple kinematic wave equation. Solutions of this equation describe the spatial and temporal development of the water table as well as the flow in the saturated and unsaturated regions. A numerical example is given. (Author's abstract)
W86-01073

COMPARISON OF GAUSSIAN CONDITIONAL MEAN AND KRIGING ESTIMATION IN THE GEOSTATISTICAL SOLUTION OF THE INVERSE PROBLEM,
Calvin Coll., Grand MI. Dept. of Engineering.
R. J. Hoeksema, and P. K. Kitanidis.
Water Resources Research, Vol. 21, No. 6, p 825-836, June, 1985. 19 Fig, 1 Tab, 11 Ref, 1 Append.

Descriptors: *Geohydrology, *Geostatistical methods, *Mathematical models, *Kriging, *Inverse problem, Transmissivity, Hydraulic head, Aquifers, Pumping, Groundwater.

Two separate applications of the geostatistical solution to the inverse problem in groundwater modeling are presented. Both applications estimate the transmissivity field for a two-dimensional model of a confined aquifer under steady flow conditions. The estimates are based on point observations of transmissivity and hydraulic head and also on a model of the aquifer which includes prescribed head boundaries, leakage, and steady state pumping. The model used to describe the spatial variability of the log-transmissivity describes large-scale fluctuations through a linear mean or drift intermediate and small-scale fluctuations through a two-parameter covariance function. The first application presented estimates the log-transmissivities using Gaussian conditonal mean estimation. The second application uses extended form of cokriging. The two methods are compared and their relative merits discussed. The extended cokriging application is applied to the Jordan Aquifer of Iowa. A comparison is also made between the conditional mean application and an analytical approach. (Author's abstract)
W86-01074

VARIANCE REDUCTION ANALYSIS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
S. Rouhani.
Water Resources Research, Vol. 21, No. 6, p 837-846, June, 1985. 4 Fig, 2 Tab, 37 Ref.

Descriptors: *Variance reduction analysis, *Sampling, *Algorithms, Groundwater, Costs, Planning, Network design.

An attempt is made to develop a data collection algorithm, known as the variance reduction analysis. The proposed method is based on an information response function (i.e., the amount of information gain at an arbitrary point due to a measurement at another site. This method was later applied to groundwater data management problems. Total variance reduction (a measure for the information gain) which is independent of measured values was used as a tool for the design and planning of such data collection schemes. By utilizing a loss function, planners can estimate monetary values of the added data. By assuming that measurement fluctuations are normally distributed, a two-piece linear loss function yielded an expected loss that was directly proportional to the square root of the kriging variance. The two indicators of information and economic gains led to an optimal sampling scheme. Based on the information gain function, selected points were ranked as prospective new sampling sites. Using the economic gain function, the optimal number of added points was calculated as a function of cost-loss ratio. The selected sequence of sites for further sampling shows a high degree of stability with respect to noisy inputs. The variance reduction analysis is an effective algorithm for the planning and design of data collection schemes in random fields. (Moore-IVI)
W86-01075

QUANTITATIVE ANALYSIS OF THE LASSEN HYDROTHERMAL SYSTEM, NORTH CENTRAL CALIFORNIA,
Geological Survey, Menlo Park, CA.
S. E. Ingebritsen, and M. L. Sorey.
Water Resources Research, Vol. 21, No. 6, p 853-868, June, 1985. 14 Fig, 2 Tab, 26 Ref.

Descriptors: *Lassen Volcanic National Park, *California, *Geothermal resources, Hydrothermal studies, Chlorides, Steam, Mathematical models, Simulation, Groundwater movement.

This conceptual model of the Lassen system is termed a liquid-dominated hydrothermal system with a parasitic vapor-dominated zone. The essential feature of this model is that steam and steam-heated discharge at relatively high altitudes in Lassen Volcanic National Park (LVNP) and liquid discharge with chloride concentrations at relatively low altitudes outside LVNP are both fed by an upflow of high-enthalpy two-phase fluid within the Park. Liquid flows laterally away from the upflow area toward the areas of high-chloride discharge, and steam rises through a vapor-dominated zone to feed the steam and steam-heated features. Numerical simulations show that several conditions are necessary for the development of this type of system, including (1) large-scale topographic relief; (2) an initial period of convective heating within an upflow zone followed by (3) a change in hydrologic or geologic conditions that initiates drainage of liquid from portions of the upflow zone; and (4) low-permeability barriers that inhibit the movement of cold water into the vapor zone. Simulations of thermal fluid withdrawal south of LVNP, carried out in order to determine the effects of such withdrawal on portions of the hydrothermal system within the Park, generally showed decreases in pressure and liquid saturation beneath the vapor zone which resulted in temporary increases and subsequent decreases in the rate of upflow of steam. A generalized production-injection scenario that could mitigate the effects of development on both the high-chloride and steam-fed features was identified. (Author's abstract)
W86-01077

IDENTIFICATION OF PARAMETER STRUCTURE IN GROUNDWATER INVERSE PROBLEM,
Shandong Univ., Jinan (China). Dept. of Mathematics.
N.-Z. Sun, and W. W.-G. Yeh.
Water Resources Research, Vol. 21, No. 6, p 869-883, June, 1985. 11 Fig, 5 Tab, 27 Ref. MAF grants CEE 81-13500 and CEE 83-01230.

Descriptors: *Groundwater, *Inverse problem, *Parameter structure, *Model studies, Optimization, Mathematical studies.

This paper develops an optimization method that can be used to identify parameter structure as well as its values in connection with the inverse problem in groundwater modeling. The complexity of the parameter structure is determined by the quantity and quality of observation data. Output least square error is used as the criterion of identification. Sensitivity coefficients at finite element nodes are evaluated by the variational method. The problem of identifying the parameter structure is formulated as a problem of combinatorial optimization. A new parameterization technique is presented for describing the parameter structure. It can represent various distributions of parameters from piecewise constant to continuous variability. Based on this representation, the combinatorial optimization problem for determining the parameter structure is then solved by a simple one-at-a-time searching procedure. Numerical experimentations are used to demonstrate the efficiency and practicality of the proposed method. (Author's abstract)
W86-01078

NUMERICAL DETERMINATION OF AQUIFER CONSTANTS,
National Univ. of Singapore. Dept. of Civil Engineering.
S. P. Rai.
Journal of Hydraulic Engineering, Vol. 111, p 1110-1114, July, 1985. 2 Tab, 5 Ref.

Descriptors: *Aquifer properties, *Mathe equations, Water storage, Transmissibility, ability, Pumping tests.

A simple method is presented by which the constants of confined infinite aquifer can be lated numerically without the necessity of fitting to calculate the values of the storage cient assumed constant for homogeneous is aquifer or the transmissibility of the aqu constant thicknesss and uniform permeabili method can be used if only a few sets of pu test data are available. The accuracy of the is of the same order as of the other gr methods. (Baker-IVI)
W86-01096

INVENTORYING GROUND WATER IN TALLINE ROCKS OF PIEDMONT RE
North Carolina State Univ. at Raleigh. D Marine, Earth and Atmospheric Sciences.
C. W. Welby.
Journal of Water Resources Planning and M ment, Vol. 111, No. 3, p 293-302, July, 1985 1 Tab, 16 Ref.

Descriptors: *Groundwater budget, *Pi Region, Geology, Pumping tests, Groundwa tential, Base flow, Groundwater movement.

A methodology is described for estim 'Ground Water Working Inventory' for the eastern Piedmont Province drawing water from crystalline rocks. The approa improve efficiency in water resource and l planning and use of surface and ground resources. Calculation of the 7-day, 10-yea day, 1 year flows from stream gage data t with application of geologic data and info calculated from 24-hr pumping tests allow lining of areas more favorable and less fa for ground water development. The Water Working Inventory based on the 7-d flow calculations allows estimates of a water to be made and permits land-use pla make rational decisions about residential c and other water-related issues. Political bo planners can use the methodology to guid opment according to how large a role water is to play in local water supply plann management. High density development discouraged in those areas where ground limited and encouraged where commitm surface water supplies have been made. A ally, the inventory provides information strengthens planning for use of ground wa supplement to surface water supplies. (A abstract)
W86-01104

PRACTICAL METHOD FOR MOD FLUID AND HEAT FLOW IN FRAC POROUS MEDIA,
California Univ., Berkeley. Lawrence B Lab.
K. Pruess, and T. N. Natasimhan.
Society of Petroleum Engineers Journal, V No. 1, p 14-26, February, 1985. 8 Fig, 2 Ref. DOE contract W-7405-ENG-48.

Descriptors: *Groundwater movement, flow, *Flow, *Porous media, *Geologic fr Numerical simulations, Geohydrology, Fr Simulation.

A multiple interacting continua (MINC) m presented, which is applicable for numeric lation of heat and multiphase fluid flow in mensional, fractured porous media. This m a generalization of the double-porosity c The partitioning of the flow domain into c tional volume elements is based on the crit approximate thermodynamic equilibrium times within each element. The thermo conditions in the rock matrix are assume controlled primarily by the distance from t

hich leads to the use of nested gridblocks. NC concept is implemented through the finite difference (IFD) method. No analyt- roximations are made for the coupling be- ie fracture and matrix continua. Instead, ient flow of fluid and heat between matrix tures is treated by a numerical method. metric parameters needed in a simulation rocessed from a specification of fracture and apertures and the geometry of the locks. The numerical implementaiton of C method is verified by comparison with tical solution of Warren and Root. Illus- pplications are given for several geother- voir engineering problems. (Author's ab-

8

ICAL REPRESENTATION OF THE ERDINGEN-HURST AQUIFER INFLU- UNCTIONS FOR RESERVOIR SIMU-

and Associates, Inc., Tulsa, OK.
hi.
Petroleum Engineers Journal, Vol. 25, 05-406, June, 1985. 1 Fig, 1 Tab, 5 Ref.

rs: *Simulation analysis, *Aquifers, udies, *Reservoirs, Mathematical analy- sion analysis, Unsteady state.

used cost-effective means of representing is to compute aquifer influx with an model. Among the more popular analyti- models in use today is the Carter-Tracy n of the van Everdingen-Hurst un- e aquifer influx calculation. An alterna- ach to the table look-up method was ng linear regression analysis to develop le analytical expressions for the van -Hurst aquifer influx influence func- ession results are presented for a variety radius/reservoir radius ratios. Besides the programming effort, the computer ened because it is no longer necessary a table look-up. The derivative of di- pressure with respect to dimensionless ined directly from differentiation of the equation for dimensionless pressure by ss time. This avoids the necessity of a numerical differentiation and ensures ematically smooth function is always gression equations are designed for use engineering applications, especially ulation. (Collier-IVI)

ATIONS ON WATER, OIL AND ROUS MEDIA,
Engineering Services Ltd., Zurich
).
bibliographic entry see Field 5B.

ON OF A MASS TRANSPORT ING ENVIRONMENTAL TRITIUM,
Amsterdam (Netherlands). Inst. voor happen.
bibliographic entry see Field 5B.

OF GROUNDWATER LEVELS TO AND TO LEAF GROWTH OF NTATIONS NEAR SALT SEEPS,
lth Scientific and Industrial Research Wembley (Australia). Div. of Research.
mbe, A. L. Rogers, H. Allison, and

drology, Vol. 78, No. 1/2, p 19-34, Fig, 1 Tab, 16 Ref, 1 Append.

*Groundwater level, *Rainfall, owth, *Salt seeps, *Western Austra- , Deforestation, Reforestation, Reve- r table, Salinity.

ative forest has caused a rise in soil and secondary salinization in south Western Australia. An experiment in reclamation began in May 1976 with the replanting of tree vegetation near salt seeps. Spectral analysis was used to relate the subsequent changes in static water levels of the groundwater to rainfall input and progressive leaf area index of two plantations on a single subcatchment. The upslope static water levels lagged the seasonal rainfall by 3-4 months, whereas the midslope levels lagged rainfall by approximately 1 month. Increasing leaf area of the plantations corresponded to decreasing groundwater levels in their vicinity. (Author's abstract)
W86-01290

SALT-WATER-FRESHWATER TRANSIENT UPCONING - AN IMPLICIT BOUNDARY-ELEMENT SOLUTION,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 5B.
W86-01291

MODELLING NON-POINT SOURCES OF NITRATE POLLUTION OF GROUNDWATER IN THE GREAT OUSE CHALK, U.K.,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 5B.
W86-01294

FLOW IN A LIMESTONE AQUIFER AS DETERMINED FROM WATER TRACING AND WATER LEVELS IN WELLS,
Kentucky Univ., Lexington. Dept. of Geology.
J. Thrailkill.
Journal of Hydrology, Vol. 78, No. 1/2, p 123-136, May, 1985. 3 Fig, 29 Ref.

Descriptors: *Groundwater movement, *Aquifers, *Limestone, *Water level, *Tracers, *Wells, *Kentucky, *Karst hydrology, Geohydrology, Springs, Streams, Perched aquifers, Potentiometric level.

The Inner Bluegrass Karst Region of central Kentucky is a fluviokarst underlain by flat-lying slightly argillaceous limestones (Ordovician). Water tracing and field observations have shown the aquifer to be divisible into groundwater basins and intervening interbasin areas. Flow in groundwater basins is in a dendritic system of solution conduits at depths as great as 35 m beneath the surface which often passes beneath surface divides to emerge at low-level springs, in contrast to interbasin areas in which the flow is shallow and generally parallels surface slopes. The availability of relatively dense water-level data in an area in which a number of water traces had been conducted allowed a comparison between the configuration of the potentiometric surface and water tracing data. The potentiometric surface map was generally consistent with the location of groundwater basins and interbasin areas. In addition, water levels near streams were found to be controlled by the stream and a few wells indicated perched aquifers. The potentiometric surface, however, failed to show narrow groundwater basins and did not adequately indicate groundwater flow directions previously established by water tracing. Although well data may furnish valuable supplemental information, water tracing is necessary to determine adequately subsurface flow directions in the region and in similar karst aquifers elsewhere. (Author's abstract)
W86-01296

HYDROLOGY OF BANK GROUNDWATER WITHDRAWALS IN THE NETHERLANDS,
Ministerie van Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
For primary bibliographic entry see Field 4B.
W86-01298

QUALITY OF WATER IN AN AQUIFER AND ITS MANIFESTATION IN PUMPING WELLS,
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Fisica.
S. Gaona-Vizcayno, T. Gordillo De A., and R. N. Farvolden.
Journal of Hydrology, Vol. 78, No. 1/2, p 165-181, May, 1985. 11 Fig, 1 Tab, 9 Ref.

Descriptors: *Water quality, *Aquifers, *Groundwater contamination, *Pumping wells, *Mexico, Water temperature, Conductivity, Wells, Water sampling.

An analysis of the water flow under pumping stress in simple stratified aquifers, and field measurements of water quality from three sites in Mexico demonstrate the kind of information that can be obtained by observing water-quality changes (temperature and electrical conductivity) with time in a pumped well. Both short-term (hours) and longterm (years) changes were recorded. Water-quality changes provide information on the water quality near and far from the pumping well, and in some cases, the relative position within the aquifer of zones of different water quality. If changes in water quality are observed for different times after the well has been in production, then zonal changes in relative yield or quality may be detected. In the cases described in the paper, a representative sample of the aquifer in which the well is screened does not necessarily indicate the quality of water that will be produced over either the short or long term. In this case the term 'representative sample' is misleading. Short-term water-quality changes should be considered in setting operating parameters for optimal water quality. (Author's abstract)
W86-01299

DECREASE OF HYDRAULIC CONDUCTIVITY IN SAND AT THE INTERFACE BETWEEN SEAWATER AND DILUTE CLAY SUSPENSIONS,
Weizmann Inst. of Science, Rehovoth (Israel).
L. C. Goldenberg.
Journal of Hydrology, Vol. 78, No. 1/2, p 183-199, May, 1985. 5 Fig, 2 Tab, 44 Ref.

Descriptors: *Permeability coefficient, *Saline-freshwater interface, *Coastal aquifers, *Clay minerals, Aquifers, Seawater, Groundwater movement, Deflocculation, Sand.

The hydraulic conductivity of the seawater-fresh groundwater interface zone in coastal aquifers may decrease due to deflocculation and dispersion of small amounts of arrangements of reactive clay minerals that exist in the rock. This dispersed phase may influence to a large degree the connectivity between the conducting pores of a sediment. A reduction of hydraulic conductivity by 2-3 orders of magnitude was observed in analytically pure sand as well as in shore sand packed in columns when an interface between seawater and a dilute suspension of montmorillonite was created. The experiments were done by introducing suspensions of 5, 15, 30 and 60 mg/l of montmorillonite to columns in which a flow of seawater has previously been established. An amount of clay as small as 0.005% was involved in the creation of low permeability. The proposed model for explanation of the observed reduction of hydraulic conductivity assumes that at a certain stage the fluid begins to behave as a non-Newtonian fluid since loose networks of clay particles trap approximately 99% of water, causing stoppage in the 'bottlenecks' of the porous medium. As a consequence the overall sediment behaves as a 'Bingham system', with a yield stress. Coating of sand grains with clay is also assumed to occur in the case of concentrated suspension. (Author's abstract)
W86-01300

GRADIENT CONTROLLED CAVES, TRAPPER-MEDICINE LODGE AREA, BIGHORN BASIN, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology and Geophysics.
P. W. Huntoon.
Ground Water, Vol. 23, No. 4, p 443-448, July-August, 1985. 6 Fig, 6 Tab. Office of Water Research and Technology, U.S. Department of the Interior, contract 14-35-000102145, project A-0340-WYO.

Descriptors: *Caves, *Geohydrology, *Trapper-Medicine Lodge Area, *Bighorn Basin, *Wyo-

ming, *Groundwater movement, Carbonates, Karst hydrology, Limestone, Permeability, Artesian basins, Hydraulic gradient.

Local steepening of hydraulic gradients dictate the locations where caves develop within a soluble rock sequence. An example of cave systems that fit this model are the extensive caves that have developed under canyons in the Trapper-Medicine Lodge recharge area where groundwater flow rates became maximized within the Madison carbonates during Cenozoic time. The Trapper-Medicine Lodge area is situated on the eastern perimeter of the Bighorn artesian basin, and serves as a recharge area for aquifers interbedded within the Paleozoic and Mesozoic section. The sediments dip gently westward at about six degrees in a homocline that is being stripped of its younger sediments by erosion. The large flow rates resulted directly from the superposition of steep local gradients on the groundwater circulation system as a consequence of the erosion of confining units in the region. Gradients within the Madison aquifer were steepest in the zones directly under and adjacent to the canyon floors. Today, average gradients in the Trapper-Medicine Lodge area are 400 ft/mi as compared to 40 ft/mi in the adjacent parts of the Bighorn basin. The permeabilities of the Madison aquifer at the time of exposure were small and were similar to those found in the unfaulted interior of the Bighorn basin. However, enhanced groundwater circulation rates through the carbonate rocks proximal to the canyons accelerated dissolution along joints in those zones. As this preferential circulation-dissolution process proceeded, caves began to develop and become highly localized under and adjacent to the entrenching canyon floors. This is exactly the condition that is found today, except caves observed today are the youngest in the system because older upper level networks have been eroded away as the canyons have deepened. The cave forming process in this area is gradient controlled, a conclusion that has possible applicability elsewhere. (Collier-IVI)
W86-01305

INTERPRETATION OF DUG WELL PERFORMANCE USING A DIGITAL MODEL,
Institute of Geological Sciences, London (England). Hydrogeology Unit.
A. R. Lawrence.
Ground Water, Vol. 23, No. 4, p 449-454, July-August, 1985. 6 Fig, 2 Tab, 6 Ref.

Descriptors: *Model studies, *Wells, *Groundwater flow, Water table, Permeability, Aquifer storage, Water storage, Aquifers, Chakpatni Test, Transmissivity.

A digital model is shown to successfully simulate the distribution of head in and around a large-diameter well during both the pumping and recovery phases. Existing methods of analysis are unsuitable for the case as described where the well partially penetrates a layered aquifer of low permeability. The weathered zone behaves as a layered aquifer. There is a time lag between an observable response in the water table and a decline in the head of the underlying, more permeable layer. After a dug well has been pumped in an aquifer of low permeability, the water level in the well rises while the cone of depression continues to expand, with a consequent fall in the water level around the well. The maximum radius of influence can be in excess of 50 m which may be reached several hours after pumping has stopped. This complex flow situation makes analysis by standard drawdown-time methods invalid. The dug well recovery rate is sensitive to the permeabilities of the fast layer but less sensitive to the aquifer storage coefficient and the permeability of the slow layer. The vertical component of ground water flow into a dug well can be important. The computed and observed water level recovery data for the dug well appears to lie as a straight line on a log-linear plot. This may be true only where the main producing zone is not dewatered and the transmissivity of the aquifer remains constant throughout the test. The Chakpatni test was modeled satisfactorily, and the computed aquifer parameters agree reasonably well with the result from a slug injection test. The hydraulic behavior of the dug well is now sufficiently well understood for investigation of optimum well design to be undertaken. (Baker-IVI)
W86-01306

SOME COMPUTATIONAL EXPERIENCES USING EMBEDDING TECHNIQUE FOR GROUND-WATER MANAGEMENT,
Nevada Univ., Reno. Dept. of Civil Engineering.
Y. K. Tung, and C. E. Koltermann.
Ground Water, Vol. 23, No. 4, p 455-464, July-August, 1985. 6 Fig, 18 Ref. Office of Water Research and Technology project A-103-NEV.

Descriptors: *Embedding techniques, *Groundwater management, *Model studies, *Las Vegas Valley aquifer, Hydraulic head, Pumpage, Groundwater movement.

A distributed parameter groundwater management model was developed using finite-difference approximations of the governing differential equation for groundwater flow in a confined aquifer. The resulting system of simultaneous equations was embedded in an optimization model, which used hydraulic heads and pumpages as unknown state variables and decision variables, respectively. The model was applied to several hypothetical examples of varying size and complexity and to one real-world example, the Las Vegas Valley aquifer. The grid spacing, time increment, bounds placed on pumpage, and the number of constraints were found to affect not only the execution time, but also whether the model would execute at all. In order to accommodate long-term management goals, a lumped transient model should be used which incorporates all time periods the model encompasses. Some objective functions, such as the maximization of the head, can be executed in a stepwise manner in which the final heads from the current period are used as the initial heads for the next period. The embedding technique proved useful for small management problems, but had numerical difficulties with the large real-world problems of considerable heterogeneity. Unless the embedding technique can become computationally efficient and stable, it should be bypassed in favor of the response matrix approach. (Author's abstract)
W86-01307

MODEL STUDY OF SALT-WATER INTRUSION TO A RIVER USING THE SHARP INTERFACE APPROXIMATION,
Kansas State Geological Survey, Lawrence.
C. D. McElwee.
Ground Water, Vol. 23, No. 4, p 465-475, July-August, 1985. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Saline water intrusion, *Rivers, *Water quality, *Smoky Hill River, *Kansas, *Model studies, *Saline-freshwater interface, Geochemistry, Geohydrology, Aquifers, Water pollution prevention.

Between Salina and Enterprise, Kansas, the salinity of the Smoky Hill River increases sharply. As a result, the river downstream at various times exceeds the recommended drinking-water-quality standards for chloride. The Smoky Hill and Kansas Rivers are important sources of water for several population centers in eastern Kansas; therefore, this problem has an impact on a significant part of the Kansas population. The source of the saline water is predominantly from groundwater dissolution of the Hutchinson Salt Member of the Wellington Formation of Permian age. The dissolution of the salt has caused a north-south trending collapsed zone called the Wellington aquifer to occur along the present eastern extent of the salt. A confining shale layer exists between the Smoky Hill alluvium and the Wellington aquifer in most areas. However, between New Cambria and Solomon, Kansas, the layer is thin and fractured, allowing the salt water to move up into the alluvium. The steady-state model presented in this study indicates that the saline water layer of the alluvium in the Smoky Hill River valley should be in an unstable condition near the river. This indicates that unstable interface upconing should be a dominant mechanism for supplying salt water to the river system. The time-varying model show
the response of the chloride discharge to a
event can be qualitatively explained by the
ble interface upconing mechanism. As the
stage rises, the saline water intrusion declin
the river stage declines, the saline water in
increases beyond its normal value and subs
the normal value over the period of a few
if no new flood events occur. During rising
stage, the river is supplying the ground
system, and the saline water intrusion or u
upconing is shut off. During falling river
bank storage and perhaps an elevated wate
cause the fresh groundwater discharge to be
er than normal, which in turn causes greate
normal saline water intrusion. In additio
time-varying model shows that several
would elapse before significant benefit wo
seen in the river system from a proposed W
ton aquifer relief-well scheme. (Author's ab
W86-01308

**LABORATORY INVESTIGATION AND A
YSIS OF A GROUND-WATER FLOWM**
Auburn Univ., AL. Dept. of Civil Engin
J. G. Melville, F. J. Molz, and O. Guven.
Ground Water, Vol. 23, No. 4, p 486-495
August, 1985. 14 Fig, 8 Ref. EPA co
CR810704-01-0.

Descriptors: *Groundwater movement, *
meters, *Measuring instruments, Aquifers,
ability coefficient.

An idealized analysis is presented which c
the hydrodynamic and thermodynamic pri
of the ground water flowmeter system, mod
(K-V Associates Inc.). Laboratory experi
procedures and results are then discusse
influence of hydraulic conductivity contr
tween the aquifer and backfill materials
analyzed theoretically and studied experim
Measurements were made of the influence
ted pipe schedule, slot orientation, backfill
als, endcap bags, isolated regions of high hy
conductivity and channelization near the
pipe wall. The basic instrument response is
consistent and predictable qualitatively in
environment. Very small channelization ar
slotted pipe casing or between the slotted p
the probe endcap can invalidate the inst
response. Additional potential complicatio
due to unknown permeability contrasts b
the aquifer matrix and the material used to
around the probe. (Baker-IVI)
W86-01310

**MOVEMENT OF VOLATILE ORG
THROUGH A FRACTURED ROCK AQ**
Geological Survey, Trenton, NJ. Water Re
Div.
For primary bibliographic entry see Field 5
W86-01311

**SIMULATED SALT-WATER MOVEME
THE NAKHON LUANG AQUIFER, BAN
THAILAND,**
Asian Inst. of Tech., Bangkok (Thailand).
Water Resources Engineering.
A. Das Gupta.
Ground Water, Vol. 23, No. 4, p 512-52
August, 1985. 10 Fig, 1 Tab, 18 Ref.

Descriptors: *Aquifers, *Groundwater mo
*Bangkok, *Thailand *Nakhon Luang,
water intrusion, Aquifer, Model studies,
matical models, Connate water, Simulation.

An attempt was made to simulate the trend
water movement in Nakhon Luang aquif
the aid of a mathematical model consider
appropriate boundary and initial conditio
parameter values inferred from available
formation on salt contamination. The ev
indicated that connate-water bodies are
dominant source of contamination. Analyti
numerical modeling procedures were used t
eate approximately the extent of the contam
source and to predict the rate of encroachi
contamination with various assumed future

s. The contaminating source is wide-
is located on the western side of the
ya River. With the present rate of
e rate of encroachment is greatest from
st direction towards to the main pump-
Estimated rates of encroachment of the
d body along four directions under
thesized pumping schemes provide
elines in planning an efficient monitor-
. The possibility of contamination due
eakage of salt water from the Bangkok
ough the abandoned deep wells needs
stigation. (Baker-IVI)

er In Soils

**OMPUTER-ASSISTED TOMOGRA-
ETERMINE SPATIAL DISTRIBU-
OIL WATER CONTENT,**
tralia Univ., Nedlands. Dept. of Soil
Plant Nutrition.
orth, and L. A. G. Aylmore.
ournal of Soil Research, Vol. 21, No.
983. 4 Fig, 1 Tab, 19 Ref.

*Computer assisted tomography,
Gamma radiation, X-rays, Soil-water-
ships, Measurement instrumentation,
ution.

l of computer assisted tomography
irect and repetitive measurement of
utions of soil water content in a non-
anner was investigated. A commer-
d X-ray CAT scanner and a conven-
scanner were used to study three
situations: a concentric ring pot uni-
l with soil and each ring equilibrated
ter content; an artificial root (alun-
nd water uptake by a single root.
t that CAT scanning can be used to
tial changes in soil water content
resolution for soil-plant studies. The
clearly be used to resolve spatial
l water content with time. Gamma
ms are considerably cheaper to con-
mmerically available X-ray systems
to be more accessible to workers in
experiments indicate that the appli-
to soil-plant studies possesses an
ing potential. (Moore-IVI)

**OF CACL2 SOLUTIONS IN AN
ED CLAY SOIL: THE EFFECT OF
ONCENTRATION,**
n Scientific and Industrial Research
Canberra (Australia). Div. of Envi-
hanics.
N. Gardiner, and D. E. Smiles.
nal of Soil Research, Vol. 22, No.
6 Fig, 2 Tab, 28 Ref.

Calcium chloride, *Solute transport,
ow, *Clays, Salts, Concentration,
lusion volume, Salt front, Wetting

olution salt concentration on the
alcium chloride during unsteady,
v in a structurally stable, calcium-
clay soil is described. Solutions of
plied at a head of -10 mm of water
olumns of soil containing solution
concentration of CaCl2 at a low
The measured apparent solution
ear the inlet were less than the
concentrations, and the identifia-
ved more rapidly than the 'piston-
er. The magnitude of both effects
n solution concentration. The ob-
nsistent with exclusion of anions
double layer at the clay surface.
between exclusion volume (or
r content) and solution concentra-
m the measurements, was affected
n of double layers at low solution
d may also be affected by water
ession was derived which permits

prediction of the position of the salt front from the properties of the initial and invading solutions. (Author's abstract)
W86-01029

MOISTURE MEASUREMENT IN A SWELLING CLAY SOIL USING NEUTRON MOISTURE METERS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
N. S. Jayawardane, W. S. Meyer, and H. D. Barrs.
Australian Journal of Soil Research, Vol. 22, No. 2, p 109-117, 1983. 6 Tab, 14 Ref.

Descriptors: *Soil water, *Neutron moisture meters, *Clays, Swelling soils, Soil texture, Density, Mathematical equations, Calibration, Measurement instrumentation, Irrigation effects, Water balance.

Neutron meters were calibrated for moisture determination in a layered swelling soil, showing changes in both swelling characteristics and texture with depth. The bulk density-moisture content relationship of each layer determined from small soil cores agreed with those predicted from in-situ swelling measurements taken during a previous study. The precision of calibration of two neutron meters were markedly improved by correcting for textural and bulk density changes with depth. The regressions of total moisture content on corrected neutron ratios were similar for the two moisture meters and comparable to those obtained for similar soils in previous studies provided that the same calibration techniques were used. For moisture determination in the field, separate calibration equations of volummetric moisture content against neutron ratios were required to account for the individual bulk density-moisture content relationship of each soil layer. The calibration equation for the surface layer had a markedly lower calibration coefficient and a much higher intercept constant than for the subsoil. Measured changes in soil moisture following irrigation using the above calibration equations of the neutron moisture meter agreed closely with values predicted by water balance within a large soil core in a lysimeter. (Author's abstract)
W86-01030

EFFECTS OF WATERLOGGING AND SUBSEQUENT DRAINAGE OF A PASTURE SOIL ON PHOSPHATE SORPTION, EXTRACTABLE PHOSPHATE AND OXALATE-EXTRACTABLE IRON,
New South Wales Dept. of Agriculture, Rydalmere (Australia). Biological and Chemical Research Inst.
For primary bibliographic entry see Field 2K.
W86-01038

UNSATURATED AND SATURATED FLOW THROUGH A THIN POROUS LAYER ON A HILLSLOPE,
Western Australia Univ., Nedlands. Dept. of Mathematics.
For primary bibliographic entry see Field 2F.
W86-01073

SIMILARITY SOLUTION OF OVERLAND FLOW ON PERVIOUS SURFACE,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W86-01092

SOME HYDRAULIC PROPERTIES OF SANDY-SILTY NORWEGIAN TILLS,
Norges Landbrukshoegskole, Aas. Dept. of Geology.
S. Haldorsen, P. D. Jenssen, J. C. Koler, and E. Myhr.
Acta Geologica Hispanica, Vol. 18, No. 3/4, p 191-198, 1983. 7 Fig, 25 Ref.

Descriptors: *Tills, *Soil hydraulic properties, *Norway, Interstitial water, Soil permeability, Soil water, Groundwater level, Capillary conductivity.

Norwegian tills are usually coarse. The saturated water movement is mainly concentrated along fractures, fissures and sorted sediment zones. The studies indicate that less than 10% of the water drains through the pore system of the till matrix. There is no marked correlation between the grain-size composition of the till and the saturated permeability. Homogeneous Norwegian tills may form important conduits of capillary water transport from the groundwater level to the vegetation during dry summers. This is mainly because the tills are dominated by equidimensional minerals which form an open pore system and because the groundwater level in many cases is situated at shallow depths. (Author's abstract)
W86-01111

INFILTRATION FROM A TRICKLE SOURCE IN A HETEROGENEOUS SOIL MEDIUM,
California Univ., Davis. Dept. of Land, Air and Water Resources.
S. A. Taghavi, M. A. Marino, and D. E. Rolston.
Journal of Hydrology, Vol. 78, No. 1/2, p 107-121, May, 1985. 9 Fig, 1 Tab, 21 Ref. CSRS project CA-D*-LAW-4350-H.

Descriptors: *Infiltration, *Trickle irrigation, *Soil water, Irrigation, Unsaturated zone, Irrigation efficiency, Irrigation practice.

Galerkin's weighted residual method was used to numerically solve the two-dimensional nonlinear partial differential equation that describes the transient movement of water in an unsaturated porous medium. The model which had been successfully used to simulate the transient moisture movement in a homogeneous soil medium was applied in a newer version to one-dimensional vertical and two-dimensional steady-state moisture flow in a heterogeneous soil medium. The computed results in the vertical infiltration problem compared well with results obtained from a Hermitian finite-element model. The results of the steady-state pressure head distributions also compared well with experimental data from a trickle irrigation source. The advantages of the existing model to other simulation models are its ability to deal with moisture movements through a very dry soil environment in a homogeneous or heterogeneous medium, as well as its ability to treat the irregularly shaped flow regions which are usually difficult to model with other numerical models. (Author's abstract)
W86-01295

ESTIMATING VERTICAL SOIL MOISTURE FLUX AT A LAND TREATMENT SITE,
California Univ., Santa Cruz. Dept. of Applied Science.
S. J. Dreiss, and L. D. Anderson.
Ground Water, Vol. 23, No. 4, p 503-511, July-August, 1985. 9 Fig, 1 Tab, 12 Ref, 1 Append.

Descriptors: *Soil water, *Land disposal, *Percolation, Path of pollutants, Soil saturation, Estimating, Soil matric suction.

In land treatment projects where wastes sludges or fertilizers are applied to the ground surface, these estimates are particularly important because subsurface water movement is the primary means of contamination migration. A sludge land treatment project that was the motivation for making percolation estimates is reviewed. The method used to compute percolation is presented and the results of the computations are discussed. Use of the zero flux plane hypothesis gives reasonable estimates of cumulative seasonal percolation when weekly measurements of moisture content and matric suction are used. A detailed description of the spatial variability of K-sat is not warranted with this method unless K-sat is very small. Soil-water percolation through marine terrace sediments in central California varies an order of magnitude between years of high and low rainfall. (Baker-IVI)
W86-01312

2H. Lakes

DYNAMICS OF COLONIZATION IN AN EXPERIMENTAL CHANNEL, FED BY THE PO RIVER WATERS,
Milan Univ. (Italy). Ist. di Biologia.
B. Rossaro.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2102-2105, 1985. 1 Tab, 6 Ref.

Descriptors: *Po River, *Italy, *Species composition, *Periphyton, Ecological distribution, Seasonal variation, Water temperature.

Seasonal factors, more than substrate exposure time, seem to control the dynamics of invertebrate colonization of air-dried Typha latifolia stems and leaves. Typha (about 500 g dry weight) was in baskets suspended in an artificial channel; the artificial channel was 22 m long, 60 cm wide, and fed by the waters of the Po River (Italy) at a constant flow rate of 1-2 cm/sec and water depth of 1 cm. Temperature, river discharge, photoperiod, dissolved oxygen, and substrate exposure time were correlated with the abundances of taxa found, after log (x+1) transformation. Water temperature, more than substrate exposure time, accounted for fluctuations in abundance. Some taxa responded to photoperiod more than water temperature. Only Bryozoa were dependent on substrate exposure time. Microhabitats provided by Typha allowed colonization by Glyptotendipes paripes. Most of the other taxa were periphyton dwellers and more or less euryecious; their colonization was mainly related to drift composition. The most abundant taxa were Naididae (Stylaria and Chaetogaster) and Chironomidae (Paratanytarsus mediterraneus, Cricotopus sylvestris, G. paripes); the gastropod Viviparus ater and the amphipod Echinogammarus stammeri were the most important in terms of biomass. (Rochester-IVI)
W86-00920

ABOUT A SOURCE OF NUTRIENTS IN THE TROPICAL RIVER RAJANG (N BORNEO) IN RELATION TO FUTURE IMPOUNDMENT,
Forschungsinstitut und Natur-Museum Senckenberg, Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 6G.
W86-00921

DRIFT IN HAWAIIAN STREAMS,
Brigham Young Univ., Provo, UT. Dept. of Zoology.
J. R. Barnes, and D. K. Shiozawa.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2119-2124, 1985. 2 Fig, 1 Tab, 31 Ref.

Descriptors: *Aquatic drift, *Hawaii, *Streams, *Macroinvertebrates, Caddisflies, Turbellaria, Oligochaetes, Harpacticoida, Crustaceans, Animal behavior.

Macroinvertebrate drift patterns were studied in four Hawaiian streams. During sampling sunset was between 19:00 and 20:00 hr and sunrise between 06:00 and 07:00 hr; sampling lasted for 24 hr, and employed 30 x 10 cm drift nets with 110 micrometer mesh netting. Turbellaria, Oligochaeta, Chironomidae, Trichoptera, Decapoda, and Harpacticoida were collected in significant densities. Turbellarians were collected only in Waiahole stream, on the island on Oahu; they exhibited a typical bigeminous drift pattern, with the initial drift peak occurring just after sunset and a secondary peak a few hours before sunrise. Oligochaetes occurred in the drift of Paakea and Waiohue streams (on Maui island) and Hanakapiai (Kauai island), and Waiahole stream. No diel patterns were apparent on Maui, but a bigeminous peak was recorded for the Hanakapiai oligochaetes. The major peak occurred shortly after sunset and a secondary peak occurred just before sunrise. Chironomid drift from both Paakea and Waiohue streams showed no diel behavioral drift pattern. Midges in Hanakapiai drifted with an alterans pattern. Cheumatopsyche analis, and introduced trichopteran, had a unimodal peak just after sunset in Waiohue, Hanakapiai, and Waiahole and a bigeminous pattern in Paakea. A juvenile atyid shrimp, which was collected in both Paakea and Waiohue, had two color phases in the drift in Paakea. The light shrimp had a bigeminous pattern whereas the dark shrimp had a unimodal nocturnal drift pattern peaking several hours after midnight. The harpacticoid copepod Nitocra spinipes was collected in the drift of Paakea, Waiohue, and Hanakapiai. Those in Paakea followed the alterans pattern, those in Hanakapiai followed the bigeminous pattern, and the Waiosue population had an alterans pattern except for a daytime peak at 16:00, which could have been due to catastrophic drift. (Rochester-IVI)
W86-00922

LIMNOLOGY OF A NATURALLY ACIDIC TROPICAL WATER SYSTEM IN AUSTRALIA; I. GENERAL DESCRIPTION AND WET SEASON CHARACTERISTICS,
AVCA, Sydney (Australia).
A. W. Morley, T. E. Brown, and D. V. Koontz.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2125-2130, 1985. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Jabiluka, *Magala River, *Australia, *Northern Territory, *Limnology, *Tropical regions, *Seasonal variation, Ecological effects, Mining, Billabongs, Fishkill, Mussels, Water pollution effects.

Major changes in water quality occur in the Magela Creek (Northern Territory of Australia) during the dry-to-wet season; as a consequence fish and other biota are significantly affected. The region in which the Magela Creek is located experiences a distinct wet and dry season, with 97% of the 1,530 mm annual rainfall occurring in the wet season (October-May). Average effective evaporation exceeds rainfall by approx 700 mm, a circumstance which is responsible for the formation of a series of discrete billabongs (water holes) of varying sizes throughout the area during the dry season. During the wet season the Magela floodplain is a continuous body of water 2-5 m deep. The waters of Magela Creek are naturally acidic and very soft, with low levels of nutrients. Regional climatic changes induce perturbations in water quality, as does ingress of groundwater into floodplain billabongs. Studies in 1979-80, 1980-81, 1981-82, and 1982-83 revealed fish kills of varying degrees of severity. In some cases acidic water with elevated aluminum levels was present at the time of the fish kills, but other kills had no obvious cause. Freshwater mussels (Velesunio angasi) also died in one of these events. The losses of biota were associated with the onset of flooding. After the floodplain became completely covered with water, water quality was excellent. Anthropogenic changes in water quality that may occur when Jabiluka uranium mining operations commence will be difficult to separate from the significant natural changes. (Rochester-IVI)
W86-00923

LIMNOLOGY OF A NATURALLY ACIDIC TROPICAL WATER SYSTEM IN AUSTRALIA; II. DRY SEASON CHARACTERISTICS,
BCLV, Morwell (Australia).
T. E. Brown, A. W. Morley, and D. V. Koontz.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2131-2135, 1985. 2 Fig, 3 Ref.

Descriptors: *Magela Creek, *Australia, *Northern Territory, *Limnology, *Acid lakes, *Seasonal variation, Ecological effects, Billabongs, Water chemistry, Fishkills, Water quality.

The degrees of change in water quality occurring in billabongs (water holes) of the Magela Creek floodplain (Australia) by the end of the dry season is primarily a function of the duration of the rain-free period, but depends additionally on other factors. Water chemistry changes correlate with fish-kills in some cases, but some fishkills have occurred without apparent cause. The dry season in this area is characterized by high temperatures and the absence of rainfall. By the end of the dry season surface water is lacking except for about 10 billabongs. Although the billabongs vary
vidual characteristics, two types are reco
Type I billabongs have steep sides; solute
tration at the end of the dry seasons is 3-5
the end of the preceding wet season.
billabongs have shallow sloping banks o
one side, with the result that surface a
depth:total volume ratios change with tim
recession of the water as the dry season pr
Solute concentration increases up to 10-f
been observed in Type II billabongs. A
ble depth reduction changes concentrati
lutes much more in a type II than a typ
bong. Some water quality parameters in
concentration during the dry season more
be accounted for by evaporation alone (ie
nese, sulfate, and potassium, and some
type II billabongs). With establishment o
rain, flooding of the Magela Creek flood
ables each of the billabongs to become dil
or flushed with streamwater, a mechan
halts the deterioration in water quality.
such annual regeneration, the ecology of
bongs probably would be irreversibly
(Rochester-IVI)
W86-00924

ZOOPLANKTON OF THE DARLING SYSTEM, AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Bota
R. J. Shiel.
Verhandlung Internationale Vereinigung
gie, Vol. 22, No. 4, p 2136-2140, 1985.
Ref.

Descriptors: *Australia, *Darling Rive
plankton, Rotifers, Turbidity, Species co
Water quality, Animal behavior.

The mainstream Darling River, Austra
ports a complex, rotifer-dominated plank
ward for more than 2,700 km from tropic
lia, with inoculations of 'temperate' spe
westward-flowing headwater rivers. Fe
cant reservoirs and high abiogenic turb
350 NTU, depth < 2 cm) characterize th
Eighty species of Rotifera were identifi
stenotherms predominate, with brachi
most abundant family. Commonly, 3-6 s
chionus and 4-7 spp or Keratella occur
collection, and they dominate numerica
cladoceran taxa identified from the ri
Bosmina meridionalis and Cerdiodaphni
were common. Cyclopoid copepods (E
Mesocyclops) were rare; calanoids
triarticulata, Calamoecia lucasi) were s
Menindee Lakes, and also were flushed
stream flows, principally in naupliar/c
stages. Each influent contributes a s
plankton, the dominants of which are
For example, of 65 taxa identified in to
collected within 2 hr, 100 km apart,
Gwydir River (31 spp, Shannon-Wien
3.90) and the Barwon River (34 spp, H
only 8 spp were shared. Plankton densiti
1 were recorded in Lake Menindee in
after initial flood flows from the Darl
with 400/l below the lake at Pooncarie,
the confluence with the Murray River
evidence of adaptation at the specific
extreme turbidity was observed in Daph
ata. A 3.00 mm specimen from the Menin
had an intersetule spacing of 0.875 +
micro-m, whereas a 3.3 mm specimen fr
Bold water-supply reservoir near Adel
0.262 + or - 0.01 micro-m spacing. Set
the Darling system specimen were
widely spaced, so that setules of paralle
not linked by hook-like tips. (Rochester-I
W86-00925

MACROINVERTEBRATE COMMUN STONES IN AN AUSTRALIAN STREAM,
Monash Univ., Clayton (Australia). Dep
ogy.
P. S. Lake, T. Doeg, and D. W. Morton.
Verhandlung Internationale Vereinigung
gie, Vol. 22, No. 4, p 2141-2147, 1985. 6
19 Ref.

s: *Macroinvertebrates, *Streambeds, *Victoria, *Acheron River, *Stones, easonal variation, Species composition, stribution, Physicochemical characteris- r analysis.

de up 95% of the fauna collected from pled 10 times between February 1979 1980 in the Acheron River, Victoria During sampling the stream had low y, pH from 7.5-8.0, and water tempera- 5.8-13.5 C. Depth of the stones in the not vary significantly during the study, velocity did. Dominant orders collect- ecoptera (16 spp), Trichoptera (14 spp), a (12 spp). Four groups with different undance trends were identified: (1) ten maximum abundance in early- to mid-) three taxa peaking in abundance in eight taxa with abundance peaks in (4) at least 6 spp that occurred in fairly mbers throughout the sampling period. principally collector-gatherers rather or-filterers, clearly comprised the dom- at all sampling times, although no clear evident with respect to changes in with time. Shredders occurred at the ities in spring-early summer and at- densities in late summer-autumn, corresponded with the peak in litter atchment's eucalypt forest and to the velocities in late summer. On every casion the number of species in the vas not significantly different from the ue of 32. Similarly, no significant dif- observed over time in areal species ber of species per stone/surface area), of animals (number of animals per e area) were highest (1,024/sq m) in nd lowest (282 animals/sq m) in late stering analysis grouped collections of August, September, and November as ut the two summer assemblages were th from this winter-spring group and ner. (Rochester-IVI)

AUNAS AND FOOD RESOURCES TS IN SMALL NEW ZEALAND UBJECTED TO DIFFERENT FOR- CTICES,
Univ., Christchurch (New Zealand). logy.
ibliographic entry see Field 4C.

ICAL INVESTIGATION OF THE RACOA, YABO, MORICHAL D CLARO IN THE EASTERN VENEZUELA,
a Salle de Ciencias Naturales, San uela). Estacion Hidrobiologica de

. Vasquez, and L. Blanco.
Internationale Vereinigung Limnolo- o. 4, p 2153-2160, 1985. 6 Fig, 1 Tab,

Uracoa River, *Yabo River, *Mori- River, *Claro River, *Venezuela, ical characteristics, *Phytoplankton, Species composition, Rotifers, Hy- concentration, Dissolved oxygen, ds, Cladocerans, Aquatic insects.

cal parameters, phytoplankton, zoo- macrophytic vegetation of four eastern plains of Venezuela were tations. Overall, water temperatures 5.0-30.0 C, pH ranged from 4.9-7.1, en (DO) ranged from 1.4-9.2 mg/l, alues of color ranged from 14-40 Pt- rty-seven genera of phytoplankton e Uraco, 31 in the Yabo, 40 in the o, and 27 in the Claro; Chlorphyta phyta were the dominant groups. ragilaria, Surirella, Melosira, Tabel- icula were the most frequently re- . Maximum phytoplankton abun- ed with increased pH and DO s low phytoplankton numbers coin- cided with low values of these parameters. In order of predominance, rotifiers, copepods, cladocerans, and insect larvae were the dominant zooplankton groups. The rotifers were represented by 17 taxa in six eurotatorian families. No clear pattern of variations in rotifer dynamics was seen. Of the different rotifers, Keratella americana was most dominant, with a maximum density of 56 organisms/l noted in March in the Uracoa River. At the same station and in the same month, Brachionus, the second most dominant genus, was found at 36 organisms/l. Copepods had a maximum density (28 organisms/l) on the Yabo River in May, and cladocerans had their greatest abundance (18 organisms/l) in May and insect larvae had their greatest abundance (22 organisms/l) in September. Macrophyte cover was relatively high in the borders of the river channel during the rainy season. Overall, 19 macrophyte families were represented in the vegetation sampled at all the stations. (Rochester-IVI)
W86-00928

RIVER TYPOLOGY OF SAO PAULO STATE, BRAZIL,
Instituto de Pesca, Santos (Brazil).
M. H. Maier, M. Takino, M. A. Basile-Martins, and M. N. Cipolli.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2161-2166, 1985. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *River systems, *Sao Paulo State, *Brazil, *Physicochemical characteristics, Seasonal variation, Water temperature, Turbidity, Dissolved oxygen, Alkalinity, Conductivity, Silica, Iron, Chloride, Ammonia, Nitrites, Orthophosphate, Hydrogen ion concentration.

Characterization of seven rivers of Sao Paulo State, Brazil, was conducted based on physicochemical parameters sampled either on a short-term basis (June-September, Sapucai Guacu and Capivari), a long-term basis (a minimum of two complete seasonal cycles, Jaguari, Mogi Guacu, Piricicaba, and Jacare Pepira), or by both approaches (Ribeira de Iguape). Temperature, turbidity, dissolved oxygen, pH, alkalinity, conductivity, silica, iron, chloride, ammonia, nitrite, and orthophosphate were determined. The rivers could be divided (by cluster analysis) into two groups: AB, characterized by conductivity of 11-46 micro-Siemens/cm (micro-S) and alkalinity of 0.2-0.4 milliequivalents (m-eq)/liter, and CD, characterized by 55-82 micro-S/cm and 0.5-0.8 m-eq/l, respectively. Chloride values helped to identify the CD group (2.9-6.6 ppm), but for the AB group chloride results probably were distorted by the presence of sewage influx, particularly during July. Both the long-term investigation and the short-term one appeared adequate to characterize these lotic environments. (Rochester-IVI)
W86-00929

STRATIFICATION AND PRIMARY PRODUCTION IN A SMALL BRACKISH LAKE STUDIED BY CLOSE-INTERVAL SIPHON SAMPLING,
Abo Akademi, Turku (Finland). Dept. of Biology.
T. Lindholm, K. Weppling, and H. S. Jensen.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2190-2194, 1985. 6 Fig, 12 Ref.

Descriptors: *Stratification, *Primary production, *Brackish lakes, *Lake Holmsjon, *Aland, *Finland, Chemocline, Bacteria, Photosynthetic bacteria, Phosphorus, Ammonia, Nitrogen.

The importance of chemocline primary production was demonstrated in Lake Holmsjon, Aland (southwestern Finland), a basin incompletely isolated from the Baltic Sea and exhibiting temporary meromixis. A new in-situ incubator, with spirally-arranged arms at 5 cm depth intervals, was used for primary production measurements in the bacterial plate. Due to stratification, the water below 3.5-4 m was anoxic in both summers studied. The high clarity of water (Secchi depth: 2-4 m) permitted phototrophic bacteria to form dense populations in the lake. Complete overturn occurred in both autumms studied. The stagnant deep water had total phosphorus of 0.3-0.5 mg P/l and ammonia N 1-3 mg/l. Steep gradients of dissolved oxygen, pH, and Eh were found by siphon samplings. Special communities of phytoplankton and bacteria were revealed. A layer of Chlamydomonas sp occurred very close to, and even with, the anoxic zone, and was often associated with peaks of chlorophyll a and primary production. Conspicuous pigment and production peaks were encountered in the upper part of the anoxic zone where purple bacteria occurred. Maximum photosynthesis (184 mg C/cu m/hr) was observed in August in a thin, but very dense layer of Chromatium sp, with a bacteriochlorophyll a value of 484 microgram/l. In the strongly reducing, anoxic deep water, dense populations of green sulfur bacteria developed in both summers; bacteriochlorophyll d reached values up to 4,000 microgram/l, but photosynthetic activity was low, probably due to low light levels. A change to cloudy weather after a long sunny period was associated with a rise in the bacterial plate from 4.1 to 3.4 m depth in August 1982. Purple bacteria (Chromatium sp) were shown to migrate downward during the day and upward at night. (Rochester-IVI)
W86-00930

PHYTOPLANKTON DYNAMICS IN A HYPERTROPHIC BRACKISH-WATER BAY,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W86-00932

DIATOM FLORA OF THE LLOBREGAT RIVER AND ITS RELATION TO WATER QUALITY,
Barcelona Univ. (Spain). Dept. de Ecologia.
X. Tomas, and S. Sabater.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2348-2352, 1985. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Diatoms, *Llobregat River, *Spain, *Water quality, *Bioindicators, Species distribution, Species composition, Seasonal variation.

A diatom checklist of the Llobregat River (Spain) is reported, with comments on longitudinal distribution of species, environmental factors, and seasonal effects. Samples were collected at 18 stations along the 156-km length of the main stem, which runs from the Pyreness to the Meditteranean Sea. Except for the last two stations downstream, which are in an area receiving wastewater, diatoms were found everywhere in quantity throughout the year; 116 spp and 34 varieties were identified. The upper four stations covered a montane zone that includes the La Baells reservoir; species richness was moderate, with very few clearly dominant species: the combined relative abundances of Achnanthes minutissima, Cymbella minuta, Diatom hiemale var mesodon, and in winter, Meridion circulare, always exceeded 80%. The next several stations, covering the zone down to the confluence with the Anoia River, exhibited a gradual replacement of species of the first zone by species of Navicula and Gomphonema. Input of salts at the three stations above, at, and just below the confluence with the Gavarresa River enriched these communities; Nitzschia spp and Cyclotella spp, characteristic of the third zone, first appeared here. The last zone, which includes very polluted reaches affected by both industries and towns, extended from the confluence with the Anoia River to the Sea. Populations here were impoverished, with only some pollution-tolerant Nitzschia spp, especially N. frustulum and N. palea, some resistant Navicula spp (N. pelliculosa, N. atomus, and N. permitis), and centric diatoms in abundance. Principal components analysis of the log-transformed percentages of 44 spp suggested relationships between the floristic zones and environmental parameters and indicated seasonal aspects in the diatom flora. (Rochester-IVI)
W86-00950

MICROFAUNA DISTRIBUTION IN SHALLOW MACROPHYTE-COVERED BASINS,
Parma Univ. (Italy). Ist. di Ecologia.

For primary bibliographic entry see Field 5D.
W86-00951

GRAYLING (THYMALLUS THYMALLUS (L.)) IN THE LOWER PART OF THE RAUTALAMPI WATERCOURSE, FINNISH LAKE DISTRICT,
Keski-Suomen Vesipiirin Vesitoimisto, Jyvaeskylae (Finland).
A. Eloranta.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2555-2559, March, 1985. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Fish populations, *Rautalampi, *Finland, *Graylings, *Lakes, Water temperature, Population dynamics, Spawning, Sport fisheries.

The history, biology and angling catches of grayling in the Rautalampi watercourse, Finland, are described. These fish are derived from the stocking, between 1922 and 1928, of some 182,000 newly-hatched embryos and fingerlings. The main study area was situated in the lower part of the Rautalampi watercourse and comprised 8 rapids and 5 large lakes. Spawning occurred from May 5th to 25th, when the water temperature exceeded 5.0 to 5.5 degrees C. All grayling reached sexual maturity by four years of age. Annuli were laid down on the scales at the start of the growth period in late April or early May. On the average there were 15-19 circuli on the scales of grayling after its first year of life. The oldest fish caught were in their seventh year of life. Males grew faster than females after the onset of sexual maturity. Somatic growth rate declined sharply after the middle of September. The rapids of the Rautalampi watercourse have been sport fishing areas since the beginning of the 1900s. Grayling catches from the lake areas were low, but those from the rapids were high, up to 26.6 kg/ha/a. The grayling is omnivorous and capable of changing flexibly from one food item to another, so that it does not get involved in disastrous food competition or starvation. (Baker-IVI)
W86-00974

CONTRIBUTION OF BACKWATERS TO THE ECOLOGY OF FISH POPULATIONS IN LARGE RIVERS. PRELIMINARY RESULTS ON FISH MIGRATIONS WITHIN A SIDE ARM AND FROM THE SIDE ARM TO THE MAIN CHANNEL OF THE RHONE,
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.
Y. Bouvet, E. Pattee, and F. Meggouh.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2576-2580, March, 1985. 7 Fig, 5 Ref.

Descriptors: *Fish migration, *Rhone River, *Backwaters, Rivers, Fish populations, Bullhead, Roach, Tench, Water temperature, Spawning, Seasonal variation.

Three species, the black bullhead, the roach, and the tench, have been seen to dominate the side arm and main channel of the Rhone river. Their occurrence turned out to be rather discontinuous in some stations over the year. Therefore the specimens were individually tagged. The bullhead spend the cold season in the upper reaches, burying into the sediment in winter. They are abundant until March and disappear in spring, probably migrating downstream, returning each year in autumn. Roach migrate up the arm in great numbers at 15 cm (two years of age) in the spring and spawn in the upper half of the arm. After about a month they disappear again, leaving these stations to the fry. Unlike that of the bullhead, the main migration of the roach does not seem to be governed by temperature. Most species of tench in the arm are large, about 40 cm, and old, about 8 to 12 yr. Therefore, their biomass is much more important than their numbers. Some tench are found in summer at the last station upstream, the only fish there at that time. Some quite sedentary specimens were recaptured on the same spot after about 100 days. Others had travelled only small distances and have not migrated downstream in the spring and upstream in autumn. (Baker-IVI)
W86-00975

LIMNOLOGY AND FISHERIES MANAGEMENT IN ZIMBABWE,
Lake Kariba Fisheries Research Inst., Kariba (Zimbabwe).
B. E. Marshall.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2671-2675, March, 1985. 1 Fig, 5 Tab, 16 Ref.

Descriptors: *Zimbabwe, *Limnology, *Fisheries management, Lakes, Reservoirs, Morphoedaphic Index, Fisheries, Fish populations, Model studies, Primary productivity, Conductivity, Phosphorus.

There are no natural lakes and few perennial rivers in Zimbabwe. About 100 large impoundments covering 43,500 ha and Lake Kariba with an area of 536,400 ha are the principal sources of fish at present. Morphometry and conductivity data are available from 33 of them, phosphates from 30, and primary production statistics only from four. While the use of empirical models is often obligatory in a developing country, there is concern about their accuracy, and because of the almost complete lack of fishery data it is difficult to verify them. The Morphoedaphic Index (MEI) is a simple and widely-used empirical model. Since the parameters are easy to estimate the MEI is particularly valuable in areas where detailed limnological studies are lacking. Conductivity is largely controlled by the major dissolved cations (calcium, magnesium, sodium and potassium), but the conductivity of Lake McIlwaine is less closely related and probably influenced by other dissolved material. This supports earlier views that using MEI in culturally enriched lakes is of doubtful validity, thus causing three Zimbabwean lakes (McIlwaine, Upper and Lower Umguza) to be excluded from further study. Recent works suggest that African reservoirs are more productive than natural lakes. Phosphorus is the major limiting nutrient in Zimbabwean lakes, except for some montane ones and those which have been culturally enriched. Most Zimbabwean data are orthophosphate, but this can be changed to total phosphorus for the MEI model. Fish yields were lower than those predicted by the MEI but higher than those from primary production. Too little is presently known about phosphorus in most Zimbabwean lakes, but the model may be useful for future estimations. (Baker-IVI)
W86-00976

FISHING AND HYDROLOGIE IN THE CENTRAL AMAZON (PECHE ET HYDROLOGIE EN AMAZONIE CENTRALE),
Universidade Federal do Rio de Janeiro (Brazil). Dept. de Biologia Marinha.
S. R. P. Annibal.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, Part 4, p 2692-2697, March, 1985. 4 Fig, 12 Ref.

Descriptors: *Fisheries, *Hydrology, *Amazon Basin, *Brazil, *Lago do Rei, Lakes, Commercial fisheries, Flooding, Fish, Population dynamics, Seasonal variation, Limnology, Varzea lakes.

Hydrologic characteristics directly affect fisheries; hydrology also affects the dynamics of exploited flooded regions in the Amazon Basin of Brazil. A study was conducted on a large varzea lake in the central Amazon and two sympatric species of commercial fish. The lake, Lago do Rei, is located on an island in the Amazon River. Data were collected on the hydrology, limnology, biology, and fish of the lake. There is a great variability in the profitability of fishing in the inundation zones of the Amazon. Considering the diversity of the existing fish fauna and the complex ecological interrelations in this region, fish culture should be based on population dynamics, environmental factors and human factors, so that an appropriate seasonal strategy can be proposed for each region. (Moore-IVI)
W86-00977

SUSPENDED SEDIMENT - MICROBIAL INTERACTIONS IN A SHALLOW TURBID IMPOUNDMENT,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien.
Verhandlung Internationale Vereinigung Li
gie, Vol. 22, No. 4, p 2726-2731, March,
Fig, 21 Ref.

Descriptors: *Primary productivity, *Tu
*Suspended sediments, *Wuras Dam,
Africa, Chorophyll, Eutrophication, B
plankton, Mineralization, Dissolved solids.

Wuras Dam (South Africa) is a small, shall
turbid impoundment which is surrounded
tensive stands aquatic plants. Water sampl
taken on a weekly basis from the surface
m) water in the basin. The turbidity of
poundment increased slowly from about 2
to about 50 NTU over the first 5 months
study. The assimilation of glucose genera
lowed Michaelis-Menten kinetics fairly w
the V-max and T1-values of the study p
reflected the dynamics of the bacterioplan
the impoundment fairly well. The V-max
cose assimilation was typical of a eutrophi
suggesting that the impoundment was eutro
the basis of its chlorophyll a concentrati
primary productivity. The suspended soli
centration of the impoundment was high a
to the ecological importance of bacterial a
to solid surfaces, a direct relationship betw
max and turbidity was expected. The fact
significant relationship was only observed w
max was lagged with respect to turbidity c
question the importance of bacterial adhe
Wuras Dam. The maximum V-max was o
served by the time that the turbidity had
stabilized again after being increased by
some 7 weeks earlier. It is possible tha
events result in a large input of allocht
organic material into impoundments such a
Dam. This organic material is probably
ized slowly over a period of weeks resultin
increased flux of dissolved organic material
stimulates the bacterioplankton. (Baker-IVI)
W86-00979

TOTAL NUMBER OF BACTERIA TROPHIC STATE INDEX,
National Inst. for Environmental Studies,
(Japan).
M. Aizaki.
Verhandlung Internationale Vereinigung Li
gie, Vol. 22, No. 4, p 2732-2738, March,
Fig, 12 Ref.

Descriptors: *Water quality, *Bacteria, *
level, Lakes, Rivers, Japan, Population dy
Nutrients, Phosphorus, Chlorophyll, Di
oxygen, Algae, Biomass, Organic matter,
late matter.

The possibility of using total number of bac
a common trophic state index in stream a
environments was examined. The total numb
determined by the acridine orange direct
(AODC) technique. Twenty-five lakes in
were surveyed during summers of 1977 t
Four streams were surveyed in winter, 198
terial number estimated by the direct cou
nique had good correlation to environmen
tors in lakes and streams. If the regression
is conducted in one or a few lakes thro
every season, no significant correlations w
tained. Total number of bacteria estima
direct count seems also to have charact
similar to total phosphorus. In this particula
the lake data used were only from the s
period, when the algal biomass and other v
were probably maximum values, resulting in
correlation between total number of bacte
other environmental factors. Particulate and
ic matter had high positive correlation coef
with the direct count when lake and strea
were used simultaneously. This suggests tha
variables significantly affect the existence o
rial populations in flowing water and lake
Others have confirmed the significance of p
late matter on the existence of bacterial pop
in aquatic environments. Nutrients seem t
only a loose correlation with the direct co
distinct from algal biomass. (Baker-IVI)
W86-00980

ION OF NUTRIENTS IN THE
RESERVOIR,
t. of Water Technology and Environ-
neering (Czechoslovakia).
bibliographic entry see Field 5B.

OF HYDROGEN SULFIDE IN
EDIMENT,
niv., Ann Arbor. Dept. of Environ-
ndustrial Health.
ette, D. P. Chynoweth, and K. H.

rch, Vol. 19, No. 7, p 875-884, 1985. 4
57 Ref. National Institute of Health
EC00030 and EPA grant 5P3-WP-177.

*Hydrogen sulfide, *Lake sediments,
, Sulfur bacteria, Proteolytic bacteria,
aerobic conditions, Sediments, Eutro-

hydrogen sulfide production in the
of sediment in two small freshwater
c Southeast Michigan, U.S.A., lakes
0.13 to 1.51 with an average of 0.46
Sulfate reductive production of hy-
e at the same sites ranged from 0.7 to
verage of 1.54 mg S/l/day. Putrefac-
n sulfide production represented 5.1-
e of 18.3-27.6%) of the total hydrogen
ced at the two lakes over an April-
y period. S-35 labeled substrates were
ate hydrogen sulfide production rates.
acteria averaged 22,000 cells/ml sedi-
sulfate reducers averaged 480 cells/
Putrefactive hydrogen sulfide pro-
lated highly with numbers of proteo-
(r sq = 0.84) but the correlation
te reduction and sulfate reducing bac-
y (r sq = 0.13). Interstitial soluble
ate, protein and organic carbon were
orrelated with hydrogen sulfide pro-
or bacteria enumeration results. Nat-
concentration (Sn) used to estimate
fide production were supported by
y results. (Author's abstract)

ERVATIONS ON THE OXYGEN
N A LAKE COVERED WITH
TIOTES L.,
(Nigeria). Dept. of Preventive and
ne.
ibliographic entry see Field 5C.

OLOGICAL STUDIES ON THE
N OF IRRIGATION PONDS IN
BASIN, HIROSHIMA PREFEC-
N,
v. (Japan). Faculty of Science.

nce, Hiroshima University, Series B,
, No. 2, p 237-297, March, 1985. 14
Ref.

Aquatic plants, *Irrigation ponds,
*Japan, Vegetation, Swamps,
rophytes, Reeds, Sedges, Rushes,
tion.

re found in the Saijo basin of Hiro-
re (Japan) because the irrigation of
has mainly depended upon the re-
n this area. The aim of the present
sify and record the plant communi-
in and around the irrigation ponds,
their ecology in relation to several
s. Three major vegetation types can
ed: the aquatic vegetation, the
vegetation, and the reedswamp and
on. Vegetation was studied by the
approach. From 147 ponds, 421
obtained. The aquatic vegetation
merged communities (Charetea),
mmunities (Potametae) and small
es (higher units are not yet decided
e Potametea two new alliances and
iation are described. The emerged shore vegetation comprises one class (Bidentetea) and two alliances, Lindernion procumbentisu and Eriocaulion hondoensis. Higher units of these alliances are not yet decided in Japan. The reedswamp and marsh vegetation (Phragmitetea) is comprised of communities of reedswamp (Phragmition communis), tall sedges (Galio brevipedunculati-Magnocaricion) and Ischaemum marsh (alliance is not yet decided). Three new associations are described in the Phragmitetea. Distribution of plant communities is influenced by water quality, fluctuations of water level and shape of pond shores. Zonation and succession of plant communities can be seen on the pond shores and in the abandoned ponds. (Author's abstract)
W86-01109

ASSESSMENT OF ECOLOGICAL CHANGES DURING THE RECENT HISTORY OF LAKE ONTARIO BASED ON SILICEOUS ALGAL MICROFOSSILS PRESERVED IN THE SEDIMENTS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoerner, J. A. Wolin, C. L. Schelske, and D. J. Conley.
Journal of Phycology, Vol. 21, No. 2, p 257-276, June, 1985. 11 Fig, 2 Tab, 80 Ref. EPA grant R810396 and NSF grant OCE-8216588.

Descriptors: *Lake Ontario, *Algae, *Paleolimnology, *History, *Ecology, Diatoms, Chrysophyta, Limiting nutrients, Eutrophication, Phosphorus, Silica, Succession, Species composition.

Quantitative analysis of siliceous algal microfossils (diatoms and chrysophytes) in a radiometrically dated core of Lake Ontario sediments shows striking modifications of the flora produced and preserved, apparently as a result of anthropogenic modification of nutrient loadings to the lake. Qualitatively similar microfossil assemblages were deposited during the period ca. 1700-1815. A single major event is recorded in assemblages deposited ca. 1769. Between this event horizon and ca. 1815 there was an apparent increase in algal production, but minimal change in species composition. A major disturbance occurred at the level of the Ambrosia horizon, ca. 1831-1847. Assemblages deposited between ca. 1855 and 1900 indicate increasing eutrophication. It is inferred that silica limitation became important by about 1860 and that the system reached its greatest effective production ca. 1900. Major modification of the flora occurred in the period ca. 1900-1945, with most local extinctions of major indigenous populations occurring ca. 1920-1945. Assemblages deposited in the period ca. 1945-1975 are composed of some stenothermal populations also present in pre-disturbance assemblages, a large component of benthic and nearshore planktonic species, and a number of apparently planktonic populations rarely recorded from large temperate lakes, particularly species of the genus Nitzschia. The results indicate that the major factor driving species succession in Lake Ontario was phosphorus enrichment and consequent depletion of available silica supplies. The results also show the importance of a species' physical niche in determining its survival under these conditions. (Author's abstract)
W86-01110

PALAEOLIMNOLOGICAL RECORD OF HUMAN DISTURBANCE FROM HARVEY'S LAKE, VERMONT: GEOCHEMISTRY, PIGMENTS AND DIATOMS,
Minnesota Univ., Minneapolis. Limnological Research Center.
D. R. Engstrom, E. B. Swain, and J. C. Kingston.
Freshwater Biology, Vol. 15, No. 3, p 261-288, June, 1985. 11 Fig, 1 Tab, 78 Ref.

Descriptors: *Harvey's Lake, *Vermont, *Geochemistry, *Diatoms, *Lake sediments, Stratigraphy, Sediments, Environmental effects, Land use, Phytoplankton, Primary production, Cyanophytes.

Stratigraphic analyses of inorganic geochemistry, pigments and fossil diatoms in a 0.7 m core of profundal sediments were used to reconstruct the limnological history of Harvey's Lake, Vermont, over the last 1000 years. The lake is moderately productive, deep (44m) and clear, and the phytoplankton today is dominated by the blue-green alga, Oscillatoria rubescens. Sedimentary pigments unique to blue-green algae, oscillaxanthin and myxoxanthophyll, provide a detailed history of changes in the O. rubescens population. Accurate sediment chronology is derived from Pb-210, Cs-137 and C-14 dating and from the stratigraphy of pollen and sawmill wastes. Primary production increased in Harvey's Lake in 1780 following European settlement and again after 1945, as shown by greater accumulation of sedimentary pigments and diatom frustules, and changes in fossil algal assemblages. Blue-green algae first appeared in abundance about 1945, indicating nutrient enrichment from dairy wastes and shoreline development. Increased deposition of elements associated with clastic minerals also suggests greater soil erosion during both of these intervals. Two episodes of increased sedimentary anoxia (1820-1920 and 1945-present) are marked in the sedimentary record by enhanced pigment preservation, changes in authigenic Fe and Mn stratigraphy, and the development of laminated sediments. The earlier episode of oxygen depletion is correlated with the discharge of sawmill wastes into the lake, and the later episode is associated with increased primary production. Based on these data a new model for Fe and Mn sediment stratigraphy was developed for lakes that do not undergo complete hypolimnetic anoxia. Fine-scale resolution of recent diatom and oscillaxanthin stratigraphy provides historical evidence for a long-term negative interaction between diatom and blue-green algal populations in Harvey's Lake. (Author's abstract)
W86-01122

ORGANIZATION OF MACROINVERTEBRATE COMMUNITIES IN THE MAJOR TRIBUTARIES OF THE LATROBE RIVER, VICTORIA, AUSTRALIA,
Museum of Victoria, Abbotsford (Australia). Survey Dept.
R. Marchant, L. Metzeling, A. Graesser, and P. Suter.
Freshwater Biology, Vol. 15, No. 3, p 315-331, June, 1985. 3 Fig, 6 Tab, 42 Ref.

Descriptors: *Macroinvertebrates, *LaTrobe River, *Victoria, *Australia, *Species composition, Species distribution, Ecology, Animal behavior, Food habits, Physicochemical characteristics.

Seventeen sites were each sampled six times over 2 years for macroinvertebrates. A range of physicochemical variables was also measured to determine which factors were related to the distribution of species. Numerical classification of the faunal data indicated that four groups of sites or communities were distinguishable: lowland sites; sandy upland sites; cobble upland sites from the northern catchment; and cobble upland sites from the southern catchment. Multiple discriminant analysis and multiple regression analysis demonstrated that particle size of the sediment, concentration of dissolved ions and altitude were the physicochemical features that were most strongly associated with changes in the faunal distribution. Abundances of shredders and predators did not vary between the site groups while those of scrapers, gatherers and filterers did: scrapers were most abundant at cobble sites while gatherers and filterers were least abundant on sand and increased in abundance downstream. The distribution of the feeding groups showed some similarity with that predicted by the River Continuum Concept, but the fact that the shredders did not decrease in abundance downstream was a notable difference. Abundance of total fauna at a site was inversely related to the amount of benthic organic matter. This feature is contrary to the pattern usually reported from rivers in the northern hemisphere.
W86-01123

QUALITATIVE ANALYSIS OF THE PELAGIC FOODWEBS OF THREE ACID-IMPACTED LAKES IN NOVA SCOTIA, CANADA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
P. A. Lane, and A. Blouin.

Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 203-220, 1985. 6 Fig, 7 Tab, 16 Ref. Canadian Wildlife Service, Environment Canada contracts OSC 81-00057, OSC 81-00129, and OSC 81-00210.

Descriptors: *Food chains, *Acid lakes, *Nova Scotia, *Kejimkujik National Park, *Cycling nutrients, *Lakes, Models studies, Loop analysis, Statistical analysis, Ecology, Phytoplankton, Zooplankton, Detritus, Rotifers, Water pollution effects.

Loop analysis is a qualitative network technique which is useful for delineating pelagic foodwebs and for predicting production relationships. Loop models were fitted to data sets for three lakes in Kejimkujik National Park, Nova Scotia. Using qualitative correlation signs, there was 80-89 percent agreement of model predictions an data values. Individual networks were integrated by summarizing linkages between pairs of variables. The resultant core network is a three-layered structure with 5 nutrient, 4 algae, 1 detritus and 10 zooplankton variables. The phytoplankton components utilize different types of nutrient complexes in each lake. Bluegreen algae have a special relationship to ammonia in Beaverskin Lake. Crustacean zooplankton consume phytoplankton directly whereas rotifers are connected to the foodweb via the detrital pool. In contrast to the multivariate statistical results reported previously, loop analysis furnished some robust evidence of the inherent structure in these plankton communities. Qualitative methodology also helps identify casual pathways in the ecological networks. The analysis illustrated which links are oscillating the most and which are expected to remain resilient with increasing perturbation. The models suggest several aspects of these communities that could be verified experimentally. (Author's abstract)
W86-01129

COMPOSITION AND PRODUCTIVITY OF THE BENTHIC MACROINVERTEBRATE COMMUNITY OF A SUBTROPICAL RESERVOIR,
Stephen F. Austin State Univ., Nacogdoches, TX. Dept. of Biology.
J. D. McCullough, and D. W. Jackson.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 221-235, 1985. 6 Fig, 6 Tab, 46 Ref.

Descriptors: *Productivity, *Benthos, *Livingston Reservoir, *Texas, *Reservoirs, Primary productivity, Secondary productivity, Phytoplankton, Species diversity, Midges, Oligochaetes.

Physical-chemical conditions, phytoplankton productivity, community structure and productivity of the macroinvertebrate benthic community were determined during 1976-77 in the subtropical Livingston Reservoir (Texas). Physical-chemical results revealed high nitrate and phosphate concentrations with highest values in the riverine segment. Large phytoplankton populations were present during most of the year. Phytoplankton productivity was high, producing an annual mean of 87 mg C/cu m/h (12 hours light/day). High turbidity in the riverine segment limited phytoplankton productivity during winter and spring. Macrobenthos was dominated by chironomids (Chironomus, Procladius, Coelotanypus and Tanypus) and oligochaetes (Limnodrilus). The annual mean benthic population was estimated at 1,626/sq m with a mean dry weight of 0.66 g/sq m. Mean benthic species diversity was 1.80. A lacustrine-riverine community gradient was revealed. Benthic productivity was 6.8 g/sq m/yr (dry weight) with a P:B ratio of 10. A low correlation was observed between benthic and phytoplankton productivity, and between phytoplankton standing crop and benthic macroinvertebrate numbers throughout the reservoir. Algal food supplies had little impact on the benthic community which was composed predominately of species which fed mostly on organic detritus. Stressful conditions caused by low dissolved oxygen concentrations probably inhibited development of the benthic community throughout the reservoir during summer months, while high sedimentation rates limited development in the head waters. (Author's abstract)
W86-01130

PHOTOSYNTHETIC ACTIVITY OF DOMINANT ALGAL SPECIES IN EUTROPHIC SHALLOW LAKE (GROSSER MUGGELSEE, BERLIN) INVESTIGATED BY MICROAUTORADIOGRAPHY,
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
B. Nixdorf.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 237-246, 1985. 8 Fig, 16 Ref.

Descriptors: *Muggelsee, *Berlin, *Germany (Democratic Republic), *Photosynthesis, *Autoradiography, *Eutrophic lakes, Phytoplankton, Productivity, Biomass, Cyanophyta, Diatoms, Isotope studies.

The photosynthetic activity of dominant phytoplankton in a eutrophic shallow lake was investigated by the autoradiographic method in 1979 and 1980. It was shown by light and dark field microscopy that all species of Cyanophyta (Oscillatoria redekei, Oscillatoria agardhii, Aphanizomenon flos-aquae) were characterized by a continuously high uptake of C-14 labeled NaHCO3. Similarly high photosynthetic activity was observed during the occurrence of Cryptomonas sp. and nanoplankton. Contrary to these observations, diatoms showed remarkably high portions of photosynthetically inactive biomass when their development was abundant. The reasons for this discrepancy between high biomass of diatoms and relatively low primary production (measured by the C-14-method and autoradiography) are discussed. (Author's abstract)
W86-01131

COMPOSITIONAL AND STRUCTURAL ANALYSIS OF PHYTOPLANKTON IN LAKE KHURPATAL, (U.P.), INDIA,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
M. C. Pant, S. Jaiswal, and A. P. Sharma.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 269-280, 1985. 6 Fig, 4 Tab, 36 Ref.

Descriptors: *Phytoplankton, *Lake Khurpatal, *India, *Physicochemical properties, Dinoflagellates, Biomass, Species composition, Species diversity.

The phytoplankton community in Lake Khurpatal (Kumaun himalya), India, was analyzed in relation to physico-chemical variables. Phytoplankton biomass ranged from 2.7 to 20.0 g/cu m in the euphotic zone of the lake. Dinoflagellates monopolized the algal community with a mean annual contribution of 94.5% to the total phytoplankton biomass. The community coefficient used to quantify the seasonal changes in algal population reflected the fact that successional episodes were not very significant, the percentage similarity among the consecutive algal samples ranging from 47.8 to 89.9%. The phytoplankton community was characterized by low species richness, low equitability and species diversity. Various ecological characteristics of the community are discussed and the phytoplankton biomass is also compared with that of some tropical and temperate lakes. (Author's abstract)
W86-01133

SOME PHYSICAL AND CHEMICAL PROPERTIES OF WATER FROM AN UNDISTURBED TROPICAL CATCHMENT AREA (GUMA DAM, SIERRA LEONE),
Fourah Bay Coll., Freetown (Sierra Leone). Dept. of Biology.
O. S. M. Mtada.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 281-285, 1985. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Physicochemical characteristics, *Tropical regions, *Guma Dam, *Sierra Leone, Suspended solids, Transparency, Magnesium, Calcium, Silicon dioxide, Carbon dioxide, Hydrogen ion concentration, Phosphorus, Nitrogen, Dissolved oxygen, Chloride, Iron.

Water sampled had a very low content suspended solids (< 1 mg/l), but its tra was high (5-8 Hazen units). The concen Mg(2+) and Ca(2+) were below 1 mg/l of SiO2 was 5.3 mg/l. Free CO2 was (15.3 mg/l) and the pH was low (< 6. conditions were accompanied by low c tions of PO4-P, total iron and NO3-N. content of the water was always below chloride concentration (8.4 mg/l) seems high for this type of freshwater. The concentration is, however, much lower known for arid areas. It is concluded geology and vegetation dominate the che the water from the Guma Dam catchm The influence of man is acknowledged far as he has protected the catchment a thor's abstract)
W86-01134

FISH ABUNDANCE RELATED TO O MATTER IN THE PLATA RIVER SOUTH AMERICA,
Instituto Nacional de Investigacion y D Pesquero, Mar del Plata (Argentina). Aguas Continentales.
R. Quiros, and C. Baigun.
Transactions of the American Fisheries Vol. 114, No. 3, p 377-387, May, 1985. Tab, 49 Ref.

Descriptors: *Fish, *Abundance, *Organi *Plata River Basin, *Argentina, *Urugua guay, *Brazil, *Bolivia, *Parana River, River, *Salto Grande Reservoir, Species tion, Species composition, Biomass, Ph ton, Nutrients, Nitrogen, Total organic Spatial distribution.

The ichthyofauna of the Plata River Basi tina, Uruguay, Paraguay, Brazil, Bolivia mainly of illiophagous (mud-eating) and d ous species. The primary productivity plankton is generally low. Regressions of mass and catch per unit effort against tota nitrogen, total organic carbon, and other indicate that much of the spatial variabili abundance is explained by the content o ganic matter in the water column. These ships are demonstrated for the Middl River and for the Salto Grande Reservo Uruguay River. More limited evidence that water column organic matter influe distribution elsewhere in the basin as well, account for the higher average fish abun the mouths of tributary rivers and strea Parana and Uruguay rivers. (Author's
W86-01149

PLASMA OSMOTIC AND ELECTR CONCENTRATIONS OF LARGEMOUT FROM SOME ACIDIC FLORIDA LAKE
Florida Univ., Gainesville. Dept. of Fish Aquaculture.
For primary bibliographic entry see Field
W86-01154

CHANGES IN THE PLEUSTIC MACRO FLORA OF 54 SMALL FINNISH LAK YEARS,
Helsinki Univ. (Finland). Dept. of Botany.
H. Toivonen.
Annales Botanici Fennici, Vol. 22, No. 1, 1985. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Finland, *Lakes, *Macr *Eutrophication, *Bioindicators, *Pleust Hydrocharis, Duckweed, Riccia, Ricci Spirodela, Stratiotes, Utricularia.

Records made in the late 1940s and the la in 54 small (0.5-200 ha) lakes in southern (about 61 degrees 30'N) were used to changes in the occurrences of ten pleus macrophytes (in order of decreasing fre Utricularia vulgaris, Lemna minor, Ut minor, Hydrocharis morsus-range, Riccia Ceratophyllum demersum, Spirodela p Ricciocarpos natans, Lemna trisulca and S aloides). The lakes mostly have brown

d represent a wide range of variation as he water chemistry, aquatic vegetation e of human influence. Most of the species n favored by increases in the nutrient f the water, and by factors making the ore sheltered. Species which are able to ll in cool waters, Lemna minor, Riccia iocarpos, have increased most in abun- e expansion of Ricciocarpos in the area is by eutrophication, and also by its general southern Finland during recent decades. phy, caused by excessive eutrophication akes, has led to the marked decline or he disappearance of some species (Stra- nna trisulca, Utricularia spp.). In heavily l lakes the submerged vegetation has ecreased, probably due to the shading he very high production of phytoplank- accounts are given of the ecological stics of the ten pleustophytes. (Author's

6

INTERACTION INFLUENCING THE UTION OF THE FRESHWATER GAMMARUS,
(Norway). Biologisk Inst.
nd, and J. Okland.
Vol. 66, No. 3, p 364-367, June, 1985. 3 f.

s: *Shrimp, *Crustaceans, *Lakes, emical characteristics, *Norway, Alti- ntain lakes, Populations, Lime, Calcium, ion concentration, Water temperature, Water pollution effects.

ous variation in the environmental fac- th-eastern Norway makes this area par- itable for field studies on the relation- een environmental factors and fauna. abundant, from 1 to 1,837 m a.s.l., and y of the surroundings as well as acid n influence their chemical characteris- land areas the distribution of Gammarus related to how rich in lime the lakes are. found in mountain lakes tolerate much s of calcium and higher H(+) concen- n populations inhabiting lowland lakes. d populations probably have a higher mand when stressed by high tempera- redict that factor interaction may be lain the distribution pattern of the spe- other parts of Europe. (Author's ab-

ETJARN, A NON-ACIDIFIED LAKE DIFIED REGION,
niv. (Sweden). Limnologiska Institu-

C. Forsberg, and R. G. Wetzel.
44, No. 2, p 324-330, April, 1985. 4 15 Ref.

*Lake Anketjarn, *Sweden, *Water *Acid lakes, Physicochemical charac- acrophytes, Sulfates, Hydrogen ion n, Alkalinity, Water pollution effects, ry.

hemical and phytoplankton analyses n Lake Anketjarn, Sweden, over a 16- 967-1982) and compared with those of ater lakes in the western portion of have experienced severe acidification period. Lake Anketjarn exhibited less than the other lakes during the first 970s and then in recent years partially ith reduced H(+) concentrations. The characteristics of Lake Anketjarn related to larger deposits of carbonate- ll in the drainage basin and more re- e extensive development of the sub- rophyte Juncus bulbosus that is adapt- benthic sources of CO2. Concentra- ate and H(+) ions have decreased in ce about 1977, leading to increases in dification-related SO4(2-) over H(+) ns. In other nearby acidified lakes have been constant since alkalinity disappeared in the early 1970s; that constancy indicated that acidification effects are readily reversible once sulfate loading is reduced. (Author's abstract)
W86-01165

SPECIES COMPOSITION AND SEASONAL SUCCESSION OF THE ZOOPLANKTON COMMUNITY OF EUTROPHIC LAHONTAN RESERVOIR, NEVADA,
Nevada Univ. System, Reno. Biology Sciences Center.
J. J. Cooper, and S. Vigg.
Southwestern Naturalist, Vol. 30, No. 2, p 232-252, May, 1985. 8 Fig, 2 Tab, 42 Ref. Office of Water Research and Technology contract 14-34-0001-0271.

Descriptors: *Species composition, *Seasonal variation, *Succession, *Zooplankton, *Lahontan Reservoir, *Nevada, Cladocerans, Copepods, Rotifers, Daphnia, Populations, Eutrophic lakes, Reservoirs, Physicochemical characteristics.

The zooplankton community of eutrophic Lahontan Reservoir, Nevada was studied during a 22-month period of 1980 and 1981. The zooplankton community consisted of seven species of cladocerans, two species of copepods and nine species of rotifers. The dominant zooplankters were the cladocerans Daphnia galeata, D. schodleri, Diaphanosoma leuchtenbergianum, and Bosmina coregoni, the copepods Cyclops vernalis, and Diaptomus sicilis, and the rotifer Keratella. Mean zooplankton density was 37.2/l in 1980 and 64.7/l in 1981. Overall, copepods comprised 50 percent, cladocerans 34 percent, and rotifers 16 percent of the total population. Biotic and abiotic factors are discussed in relation to their potential influence on zooplankton community structure. (Author's abstract)
W86-01168

RECOVERY OF A STREAM INVERTEBRATE COMMUNITY FROM A FLASH FLOOD IN TESUQUE CREEK, NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Biology.
M. C. Molles, Jr.
Southwestern Naturalist, Vol. 30, No. 2, p 279-287, May, 1985. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Benthos, *Streams, *Tesuque Creek, *Santa Fe National Forest, *New Mexico, *Flash floods, *Floods, Ecological effects, Biomass, Species diversity, Streambeds, Flood damage.

In mid-August 1977, a flash flood disrupted the benthic community of one fork of Tesuque Creek, Santa Fe National Forest, New Mexico. One year after the disturbance, the invertebrate communities of flooded and unflooded forks were similar in biomass, numbers, and species diversity. However, even after 2 years some difference in community composition remained. Oligochaetes showed no clear effect from the flood or its aftermath. Diptera recovered rapidly. Ephemeroptera, Plecoptera and Trichoptera recovered at intermediate rates, and Coleoptera recovered most slowly. Recovery proceeded at approximately equal rates upstream and downstream from the undisturbed fork. Comparing preflood to postflood collections yielded approximately the same picture of recovery as comparing postflood collections from undisturbed and disturbed reaches. (Author's abstract)
W86-01170

COLLOIDAL STABILITY OF PARTICLES IN LAKES: MEASUREMENT AND SIGNIFICANCE,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
W. Ali, C. R. O'Melia, and J. K. Edzwald.
Water Science and Technology, Vol. 17, No. 4/5, p 701-712, 1985. 5 Fig, 2 Tab, 18 Ref. NSF grant CEE81-21501.

Descriptors: *Particulate matter, *Particle stability, *Colloids, *Lakes, Aggregation, Fate of pollutants, Colloids, Model studies, Simulation, Hydraulic loading, Dissolved solids, Organic carbon, Solid-solute partitioning.

Under certain chemical conditions, contacts between particles in lakes result in attachment of the colliding particles to form aggregates (the process of coagulation). Model simulations of the effects of particle stability, solid-solute partitioning, and hydraulic loading on the transport and fate of particles and associated pollutants and nutrients were made. Lakes vary widely in hydraulic loading and pollutants vary widely in partition coefficients. Natural particles are rather unstable in lakes, but colloid stability is expected to depend on the hardness and dissolved organic carbon in the water; these also vary widely among lakes. As a result, lacustrine systems are expected to differ appreciably in their ability to assimilate pollutants. A model has been developed to provide a basis for predicting deposition and pollutant concentration in these systems. (Moore-IVI)
W86-01194

PHOSPHORUS, NITROGEN AND CHLOROPHYLL-A CONCENTRATIONS IN A TYPICAL DUTCH POLDER LAKE, TJEUKEMEER, IN RELATION TO ITS WATER REGIME BETWEEN 1968 AND 1982,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
H. De Haan, and J. R. Moed.
Water Science and Technology, Vol. 17, No. 4/5, p 733-743, 1985. 7 Fig, 2 Tab, 14 Ref.

Descriptors: *Phosphorus, *Nitrogen, *Chlorophyll a, *Tjeukemeer, *Netherlands, Polder lakes, Hydrologic budget, Climate, Limiting nutrients, Chlorophyll a, Algae, Eutrophication.

Tjeukemeer is the largest lake in the province of Friesland, The Netherlands. The lake is connected with other lakes in the region by canals; the interconnected lake system is used to regulate the water table of the low-lying surrounding polders. The mean concentrations of total phosphorus and total nitrogen in the Tjeukemeer during the summer season between 1968 and 1982 were 0.215 and 3.8 mg/l, respectively. These values exceeded water quality standards for The Netherlands. Though the mean summer chlorophyll-a (chl-a) concentration of 116 micro-g/l for 1968-1982 was comparable with that for the basic quality standard, the mean concentrations between 1977 and 1982 were from 1.3 to 2.1 as high. Multiple regression analysis demonstrated that the P and N concentrations in Tjeukemeer in summer and in winter were significantly correlated with the deficit or surplus of water and consequently with the man-made regime. Between 1979 and 1982 the ratios (w/w) of the mean concentrations of total N and total P and those of particulate N and particulate P in summer were less than 16 and 10, respectively, indicating that phytoplankton growth was N rather than P limited. (Moore-IVI)
W86-01196

QUANTIFICATION OF WIND INDUCED RESUSPENSION IN A SHALLOW LAKE,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
R. H. Aalderink, L. Lijklema, J. Breukelman, W. van Raaphorst, and A. G. Brinkman.
Water Science and Technology, Vol. 17, No. 6/7, p 903-914, 1985. 5 Fig, 2 Tab, 10 Ref, 2 Append.

Descriptors: *Resuspension, *Wind, *Lakes, *Suspended sediments, Mass balance, Sedimentation, Wave action, Shear stress, Mathematical models.

The mass balance of suspended solids in a shallow lake was modelled as the net result of resuspension and settling. Four different formulations for the flux of resuspension were used. Two equations were based on the conception of wave induced resuspension, the other two used the flow field induced shear stress as the driving force for resuspension. Parameter estimations based on experimental time series of wind velocity and SS concentration produced lower least square values with the models based on flow induced resuspension. The model parameter representing settling was in reasonable accordance with the settling velocity obtained from sediment traps. The spread in results can be explained by a lack of homogeneity and horizontal transport. (Author's abstract)

W86-01230

CALCULATION OF TRANSPORT COEFFICIENTS OF PHOSPHATE AND CALCIUM FLUXES ACROSS THE SEDIMENT-WATER INTERFACE, FROM EXPERIMENTS WITH UNDISTURBED SEDIMENT CORES,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Technology.
For primary bibliographic entry see Field 2J.
W86-01233

CONTRIBUTION OF AGRICULTURAL LOADING TO EUTROPHICATION IN FINNISH LAKES,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5B.
W86-01247

INDICATIONS OF THE CAPACITY FOR RAPID REVERSIBILITY OF LAKE ACIDIFICATION,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 5B.
W86-01279

DISSOLVED INORGANIC PHOSPHORUS IN STREAMS OF THE INDIAN ARID ZONE,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 2J.
W86-01292

ANALYSIS OF THE BENTHIC MACROINVERTEBRATE COMMUNITY OF A FLUCTUATING RIVER-RESERVOIR ZONE IN MIDDLE TENNESSEE,
Florida State Dept. of Environmental Regulation, West Palm Beach.
For primary bibliographic entry see Field 6G.
W86-01317

CHEMICAL COMPOSITION OF BOTTOM SEDIMENTS AND PHYTOPLANKTON IN THE MAN-MADE LAKE ZEMBORZYCE NEAR LUBLIN,
Akademia Rolnicza, Lublin (Poland). Inst. of Soil Science and Agricultural Chemistry.
M. Misztal, D. Krupa, and H. Smal.
Acta Hydrobiologia, Vol. 25/26, No. 2, p 123-133, 1983/1984. 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Chemical composition, *Lake Zemborzyce, *Poland, *Bottom sediments, Chemical analysis, Sedimentation, Lakes, Lake sediments.

An analysis was made of the chemical composition of bottom sediments in the man made Lake Zemborzyce near Lublin. Chemical composition of the sediments and its possible relation to the specific composition and percentage content of the systematic groups in the total numbers of phytoplankton was also studied. The content of carbon, nitrogen, and calcium in the reservoir bottom is shown on maps. No relationship appeared to exist between the composition of phytoplankton and the content of the basic available biogens in the sediments. (Baker-IVI)
W86-01319

2I. Water In Plants

COPING WITH DROUGHT BY THE SEA,
King's Coll., London (England). Dept. of Plant Sciences.
P. D. Moore.
Nature, Vol. 315, No. 6019, p 455-456, June, 1985. 1 Fig, 6 Ref.

Descriptors: *Drought, *Plant physiology, *Water stress, Water requirements, Water potentials, Crassulacean acid metabolism.

Plants subjected to periodic or constant water stress display crassulacean acid metabolism (CAM), which is a photosynthetic strategy. A similar phenomenon was recently, surprising, observed in an oceanic member of the Crassulaceae, Umbilicus rupestris (wall pennywort) in response to a drought situation. Some succulent species of plants accumulate acid in their tissues during the night. Leaf acidification is accompanied by the nocturnal uptake of carbon dioxide and a temporary fixation of carbon by the enzyme phosphoenolpyruvate carboxylase into a 4-carbon compound, oxaloacetate. This was subsequently converted to malate. There are clear energetic advantages in the adoption of a flexible system in which it is possible to switch to CAM only during periods when it is of advantage to the survival of the plant, such as in times of water stress. Some species switch to an incomplete form of CAM when experiencing drought. This type of CAM idling has been noted in Umbilicus rupestris when exposed to drought conditions. Evidently the falling water potentials in the plant activate a metabolic switch, but the nature of the operation of this switch is still unknown. Why an oceanic species should posses this unusual capacity for dealing with drought appears to be related to its preferred habitat. Umbilicus rupestris grows in cliff crevices and stone walls, and sometime even grows as an epiphyte in larger plants. In such exposed locations the threat of drought is very real. (Baker-IVI)
W86-01112

STOMATAL RESPONSES AND WATER RELATIONS OF EUCALYPTUS PAUCIFLORA IN SUMMER ALONG AN ELEVATIONAL GRADIENT,
Innsbruck Univ. (Austria). Botanisches Inst.
For primary bibliographic entry see Field 2D.
W86-01163

2J. Erosion and Sedimentation

EFFECT OF KINETIC ENERGY OF EXCESS RAINFALL ON SOIL LOSS FROM NON-VEGETATED PLOTS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Soils.
P. I. A. Kinnell.
Australian Journal of Soil Research, Vol. 21, No. 4, p 445-453, 1983. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Kinetic energy, *Rain, *Soil loss, Sheet erosion, Soil erosion, Rainfall intensity, Infiltration, Acceptance rate.

In situations where much of the energy required to generate erosion is derived from raindrop impact, soil loss is greatest when runoff occurs. The energy of raindrops is therefore less effectively used in generating soil loss when runoff is absent than when runoff is present. Data obtained from three 0.01 ha runoff and soil-loss plots, established with a bare fallow treatment on a yellow podzolic (Albaqualf) soil and slope gradient of 4.2%, were analyzed in terms of the kinetic energy of raindrops and the efficiency of the use of that energy in generating soil loss. The difference between rainfall intensity and the average infiltration (acceptance) rate of the soil during an event can be used to estimate variations in the efficiency of use of rainfall energy in generating sheet erosion. The product of the rainfall kinetic energy and the excesses in rainfall intensity may prove to be a useful index of the ability of rain to cause sheet erosion, but the product should not be considered as a direct substitute for EI30 in the Universal Soil Loss Equation. (Moore-IVI)
W86-01028

FIELD RAINFALL SIMULATOR STUDIES ON TWO CLAY SOILS OF THE DARLING DOWNS, QUEENSLAND. III; AN EVALUATION OF CURRENT METHODS FOR DERIVING SOIL ERODIBILITIES (K FACTORS),
Queensland Dept. of Primary Industries, Toowoomba (Australia). Wheat Research Inst.
R. J. Loch.
Australian Journal of Soil Research, Vol. 22, No. 4, p 401-412, 1984. 2 Fig, 2 Tab, 32 Ref.

Descriptors: *Soil erosion, *Rainfall simul
Universal Soil Loss Equation, Runoff, Simul
Tillage, Slope length, Soil erodibility.

Simulated rain has been widely used to deriv
erodibility (K) values for the Universal Soil
Equation (USLE). Because of concern that
work using smaller plots may not give re
results, this paper considers the effects o
length and erosion process on values of K de
from rainfall simulator studies. It also high
problems in the calculation of K from r
simulator data, using the factors of the U
Rainulator data on slope length/erosion p
interactions were used to calculate soil losse
K for plot lengths of 10.7 and 22.5 m tilled u
down the slope, on two soils, both on 4% slo
showed up to threefold variation with chan
plot length, because different erosion proc
contributed to soil loss. The results also sh
major differences between single-event and a
average responses of erosion to slope length,
ing to the conclusion that the annual averag
tors of the USLE cannot be used to analyze s
event rainfall simulator data. Instead, rainfall
lator data must be converted to average annu
losses, which can then be validly analyzed,
the factors of the USLE, to derive K. The p
dures presently used to calculate annual av
soil losses from rainfall simulator data do no
into account erosion process/runoff rate in
tions, and are therefore unsatisfactory. S
event soil loss models may provide a mean
producing better estimates of annual averag
losses suitable for the derivation of K. (Au
abstract)
W86-01037

**FLUID AND SEDIMENT INTERACT
OVER A PLANE BED,**
Delaware Univ., Newark. Dept. of Civil Eng
ing.
N. Kobayashi, and S. N. Seo.
Journal of Hydraulic Engineering, Vol. 111, N
p 903-921, June, 1985. 6 Fig, 23 Ref, 1 Ap

Descriptors: *Mathematical models, *Sedi
transport, *Sediment-water interactions, Fri
Bed roughness, Model studies, Open cha
Beds.

A mathematical model is developed for the
and sediment interaction in an erodible cha
The model is based on the conservation of
and momentum for the fluid and sediment.
interaction between the fluid and sediment, as
as the interaction of sediment particles movi
the vicinity of the bed is described in the m
An analysis is performed to derive the ve
distributions of the fluid velocity and sedi
concentration over a plane bed in a wide
channel. The analysis yields the friction facto
to the combined effects of grain roughness
sediment movement, as well as the rate of sedi
transport. The developed model agrees with
ing data for plane beds. The predicted ra
transport of coarse sediment agrees with
Meyer-Peter and Muller formula. However
tailed measurements of the fluid velocity and
ment concentration over a plane bed are req
for a rigorous verification of the developed m
(Author's abstract)
W86-01045

**SEDIMENT TRANSPORT UNDER
COVER,**
National Water Research Inst., Burlington (O
io). Environmental Hydraulics Section.
Y. L. Lau, and B. G. Krishnappan.
Journal of Hydraulic Engineering, Vol. 111, N
p 934-950, June, 1985. 12 Fig, 3 Tab, 16 R
Append.

Descriptors: *Ice cover, *Sediment trans
*Mathematical equations, Free surfaces, Velo
River beds, Shear stress, Eddy viscosity, Susp
ed sediments, Bed load, Slope, Friction.

The effects of a floating cover on sediment t
port characteristics were investigated through
periments with equal discharge and bed slope

and covered flows. The results were
elop a method for calculating the sedi-
ort in ice-covered flows. The presence
over exerts a tremendous influence on
cs of flow and sediment transport in a
se the wetted perimeter is almost dou-
a cover is formed, the total boundary
eased, causing an increase in the flow
decrease in the average velocity. The
tress and the eddy viscosity are both
the corresponding free-surface flow
ability of the flow to entrain and
iment is diminished. The resulting de-
iment concentration, coupled with the
low velocity, substantially reduces the
ediment transport. The ability of the
port material as bed load is also direct-
y the bed shear stress. Sediment trans-
some of the experimental runs with a
er were much smaller than the free-
values even though the changes in
city were not large. Given the same
d bed slope, the presence of a top
ot have a significant effect on the bed
istics. The lower layer in a covered
treated as a free-surface flow for the
lculating bed load transport. (Moore-

RIAL MOVEMENT IN HYPER-
ATED FLOW,
Vater Conservancy and Hydroelectric
rch, Beijing (China).

draulic Engineering, Vol. 111, No. 6,
une, 1985. 10 Fig, 10 Ref, 1 Append.

Hyperconcentrated flow, *Bed load,
ad, Suspended sediments, Sedimenta-
, Clay, Flow intensity, Dunes, Beds.

experiments was made in a closed
onduit with bentonite as fine particles
eads as coarse particles. Compared
lear water, in bentonite suspensions
les settle more slowly and start
higher flow intensity. Due to the
ld velocity and smaller settling ve-
d load is smaller and the suspended
As a result, the total load, consisting
d and the suspended load, is smaller
w intensity region, but larger in the
ensity region. The increase of the
d favors the transition from dunes to
in clay suspension dunes are lower,
hange to plane bed at lower flow
espondingly, the form resistance is
suspension. (Author's abstract)

PIER SPACING ON SCOUR
IDGE PIERS,
niv. (England). Dept. of Civil Engi-

bliographic entry see Field 8B.

N OF ALLUVIAL CHANNEL

., Pasadena, CA.
.
raulic Engineering, Vol. 111, No. 7,
July, 1985. 18 Ref. NSF grant

lluvial channels, *Data collections,
sport, Channels, Flow discharge,
hology, Bed form, Particle size,
ure, Computers.

n was undertaken to develop a
collection of alluvial channel data.
have been reduced to a standard
its. The following 10 variables are
ch observation: discharge, width,
edian particle size of the bed-mate-
specific gravity, concentration,
d bed form. In all, 5,263 records of
tions from 56 laboratory investiga-
tions, and 1,764 records of observations from 24 field investigations have been included. The data collection is available in both report and magnetic tape format from the California Institute of Technology, Pasadena, California. (Baker-IVI)
W86-01097

ESTIMATION OF DISCHARGE AND LOADS FROM THE RIVERS FLOWING INTO LITTORAL SEAS OF CHINA (IN CHINESE),
Academia Sinica, Beijing (China). Inst. of Geography.
T. Cheng, and C. Zhao.
Acta Geographica Sinica, Vol. 39, No. 4, p 418-427, December, 1984. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *China (Peoples Republic), *River flow, *Sediment loads, *River, *Seas, *Coastal waters, *Donghai, *Nanhai, *Pacific Ocean, *Bohai, Rivers, Sediment transport, Seasonal variation, Annual distribution, Precipitation.

Based on the data collected from 164 hydrological stations situated at downstream river regions (3022 station years up to 1979) the annual averages of runoff and loads flowing into the seas from the rivers in littoral areas of China were estimated; they are approximately 1800 cu km and 2000 million tons respectively and account for 4.6% and 11.5% of the total world volume, while the content of soluble substances in the runoff is about the same as that of the world. Under annual average, the Donghai receives most of the discharge (approximately 64.5% of the total), Nanhai comes next, and the Pacific receives the least. The distribution of runoff that empties into the seas both in dry and wet years is comparable to that of the annual average; the most apparent variation of dry and wet years is observed in Bohai, while variation in Donghai and the Pacific are not as apparent. The Bohai also show the most apparent variation in sediment transport. During 1970-1979, both runoff and loads discharged into Bohai decreased and increased in Nanhai. In addition to the impact of periodic variation of precipitation in drainage areas, the increase and decrease of runoff is also affected by human activities; an example is when the precipitation of drainage areas varies little but, due to human activities, the runoff decreases. Since the last decade, the amount of runoff discharged into Donghai decreased slightly, but the loads increased accordingly; an increase of 5.4% has been observed. Yearly and seasonal variations of runoff and loads discharged into the seas are controlled by the major rivers that emptied into the sea areas. The variation of runoff and loads of most rivers within the sea area are consistent with each other. (Author's abstract)
W86-01167

EROSIONAL PROCESS OF COHESIVE SEDIMENTS,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
T. Kusuda, T. Umita, K. Koga, T. Futawatari, and Y. Awaya.
Water Science and Technology, Vol. 17, No. 6/7, p 891-901, 1985. 14 Fig, 6 Ref.

Descriptors: *Sediment erosion, *Cohesive sediments, Chikugo Estuary, Japan, Shear stress, Estuaries, Velocity, Simulation, Mathematical models.

Tests on erosion of the cohesive sediments in the Chikugo estuary in Japan were conducted. The results indicate that the decrease in the rate of erosion at constant shear stresses is caused rapidly 20 to 30 minutes after the start of tests and that the decrease in caused by the increase in the solid fraction and the yield value of the sediment remaining uneroded due to shear stress. In order to simulate the erosion process of sediments, a model in which the increase in the yield value of sediment is assumed to be proportional to the integration value of the absolute value of the sediment velocity gradient with respect to time was developed. The simulation based on this model is shown to be available to estimate the amount of sediments eroded in the erosional process of cohesive sediments. (Author's abstract)
W86-01229

QUANTIFICATION OF WIND INDUCED RESUSPENSION IN A SHALLOW LAKE,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
For primary bibliographic entry see Field 2H.
W86-01230

BEHAVIOUR OF SUSPENDED SEDIMENTS AND MUDS IN AN ESTUARY,
Iwate Univ., Morioka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W86-01231

CALCULATION OF TRANSPORT COEFFICIENTS OF PHOSPHATE AND CALCIUM FLUXES ACROSS THE SEDIMENT-WATER INTERFACE, FROM EXPERIMENTS WITH UNDISTURBED SEDIMENT CORES,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Technology.
W. van Raaphorst, and A. G. Brinkman.
Water Science and Technology, Vol. 17, No. 6/7, p 941-951, 1985. 4 Fig, 4 Tab, 15 Ref.

Descriptors: *Sediment-water interfaces, *Phosphates, *Calcium, *Solute transport, Lake sediments, Interstitial water, Benthic environment, Desorption, Chemical kinetics.

Transport of dissolved materials across the sediment-water interface is an important factor, affecting the chemical characteristics of lakes. For calculating benthic fluxes, concentration gradients and transport coefficients have to be known. Fluxes of phosphate and calcium across the sediment-water interface of six undisturbed cores from a shallow lake were investigated in the laboratory. Study of the accuracy of porewater extraction and the influence of this sampling upon the experiments indicates that sampling time should at least be one day. Continuous and batch experiments resulted in a rapid release of phosphorus and calcium from the sediment. The influence of induced seepage could not be shown. On a theoretical base, the benthic fluxes are fed by desorption at or just below the interface, rather than by diffusion from deeper layers. Interstitial water data could not directly be used for calculating the driving forces of these fluxes. Instead, end-concentrations in the overlaying water of the batch experiments are used, which resulted in transport coefficients which are in good agreement with theoretical as well as field data. A good interpretation of measured fluxes is only possible when a good estimation can be made of the kinetics of the chemical reactions in the sediment; core experiments should be accompanied by such analysis. Values for the equilibrium concentration are needed, which can best be obtained from batch experiments. Core experiments can be useful in studying the transport of solutes across the sediment-water interface. (Moore-IVI)
W86-01233

DISSOLVED INORGANIC PHOSPHORUS IN STREAMS OF THE INDIAN ARID ZONE,
Central Arid Zone Research Inst., Jodhpur (India).
J. S. Choudhari.
Journal of Hydrology, Vol. 78, No. 1/2, p 49-59, May, 1985. 6 Fig, 3 Tab, 19 Ref.

Descriptors: *Inorganic phosphorus, *Phosphorus, *Nutrients, *Luni River basin, *India, *Streams, *Deserts, Arid climates, Intermittent streams, Suspended solids, Lithology, Slopes.

Streams of arid regions, which flow only in direct response to torrential rainfall have not been studied for P concentration. Total dissolved inorganic phosphorus concentrations in stream waters of the Luni River basin in the northwest-Indian desert were determined during 1980 and 1981; previous reports indicate that dissolved inorganic P constitutes a major portion of total P in those stream waters. The P concentration varied between 0.03 to 4.56 micro-g/ml PO4(-3) in various streams. The Upper Luni, Mitri, Khari and Sagi streams showed higher concentrations of P during both years of study compared to those of the Guhiya, Bandi, Jojri and Khari Bandi streams. This could possibly

be due to variation in soil cover and slope gradient. Former streams draining hilly terrain with shallow gravelly weathering surfaces and greater slopes, could have increased the effective soil mass that interacted with runoff and generated higher concentrations of P. Suspended solids, produced by low-energy runoff from dry, loose soil surfaces formed during dry periods, and flow characteristics govern the concentration of total dissolved P in streams of the Indian arid region. Flow characteristics, lithology, transmission losses and soils which control the production and transportation of suspended solids influence the P concentration of stream waters in this arid region. (Collier-IVI)
W86-01292

GRADIENT CONTROLLED CAVES, TRAPPER-MEDICINE LODGE AREA, BIGHORN BASIN, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W86-01305

2K. Chemical Processes

EFFECTS OF WATERLOGGING AND SUBSEQUENT DRAINAGE OF A PASTURE SOIL ON PHOSPHATE SORPTION, EXTRACTABLE PHOSPHATE AND OXALATE-EXTRACTABLE IRON,
New South Wales Dept. of Agriculture, Rydalmere (Australia). Biological and Chemical Research Inst.
J. Bradley, I. Vimpany, and P. J. Nicholls.
Australian Journal of Soil Research, Vol. 22, No. 4, p 455-461, 1984. 3 Fig, 26 Ref.

Descriptors: *Waterlogged soils, *Drainage effects, *Phosphates, *Iron, Pastures, Sorption, Soil chemistry, Seasonal variation, New South Wales.

Undisturbed cores of a pasture soil from the central tablelands of New South Wales were waterlogged for periods varying from 4 to 42 days and then drained to simulate seasonal waterlogging. Phosphate sorption, Bray 1 extractable phosphate and oxalate-extractable iron levels were measured before watering, at the end of waterlogging and up to 90 days after draining. Increasing the duration of waterlogging increased the logarithms of phosphate sorption and Bray 1 extractable phosphate linearly, but the response equation of log oxalate iron was significantly quadratic. When drained, all three levels fell, but the positive sorption response to waterlogging remained 90 days after draining. These results are consistent with those from previous studies that found phosphate solubility to be associated with the reduction of iron during waterlogging and its subsequent oxidation on drying. The agronomic implication of the findings for superphosphate topdressing of seasonally waterlogged soils is discussed. (Author's abstract)
W86-01038

LAKE ANKETJARN, A NON-ACIDIFIED LAKE IN AN ACIDIFIED REGION,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 2H.
W86-01165

APPLICATION OF INFORMATION ABOUT CONDUCTIVITY IN THE COMPUTING OF ION CONCENTRATIONS, ILLUSTRATED BY CERTAIN SURFACE WATERS SITUATED IN LOWER SAXONY,
Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Stadtbauwesen.
For primary bibliographic entry see Field 5A.
W86-01224

CALCULATION OF TRANSPORT COEFFICIENTS OF PHOSPHATE AND CALCIUM FLUXES ACROSS THE SEDIMENT-WATER INTERFACE, FROM EXPERIMENTS WITH UNDISTURBED SEDIMENT CORES,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Technology.
For primary bibliographic entry see Field 2J.
W86-01233

MODEL STUDY OF SALT-WATER INTRUSION TO A RIVER USING THE SHARP INTERFACE APPROXIMATION,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 2F.
W86-01308

2L. Estuaries

COMPARISON OF PLANKTONIC AND PERIPHYTIC MICROALGAL PARAMETERS AS INDICATORS OF EUTROPHICATION IN A BALTIC ARCHIPELAGO: ANNUAL SUCCESSION OF COMMUNITY PARAMETERS,
Tvarminne Zoological Station (Finland).
For primary bibliographic entry see Field 7B.
W86-00931

WAVE FORCES ON VERTICAL WALLS,
New South Wales Univ., Kensington (Australia). School of Mathematics.
For primary bibliographic entry see Field 8B.
W86-01098

DOMINANT SHEAR STRESSES IN ARRESTED SALINE WEDGES,
Thessaloniki Univ., Salonika (Greece). Dept. of Civil Engineering.
V. Dermissis, and E. Partheniades.
Journal of Waterway, Port, Coastal and Ocean Engineering, Vol. 111, No. 4, p 733-752, July, 1985. 10 Fig, 17 Ref. NSF grant ENG. 76-11537-A01.

Descriptors: *Saline wedge, *Shear stress, Mathematical models, Velocity, Saline-freshwater interfaces, Friction, Bed resistance, Density.

The shear stresses in saline wedges have been investigated in a 20 m long variable slope flume by the following approaches: (1) Direct measurements of velocities and Reynolds stresses through hot film anemometers; (2) integration of the equations of motion; (3) Schijf-Schoenfeld's one-dimensional model; (4) integration of the equations of motion assuming zero bed stress. It was found that the interfacial and bed friction coefficients, fi and fo, respectively, can best be correlated with the number ReFr sq, in which Re is the Reynolds number, and Fr is the nondensimetric Froude number and with the relative density delta p/p taken as an independent parameter. The results are given as a family of curves with each curve corresponding to a specific delta p/p. The scattering of data is small and the agreement with results of earlier studies is good. Values of fi determined by the first two approaches agree closely, as do values obtained by the third and fourth approach. However the latter are substantially higher than the first. This is indicative of a strong effect of the bed resistance on the interfacial friction. (Author's abstract)
W86-01099

PREDICTED EXTREME HIGH TIDES FOR CALIFORNIA: 1983-2000,
Scripps Institution of Oceanography, La Jolla, CA.
B. D. Zetler, and R. E. Flick.
Journal of Waterway, Port, Coastal and Ocean Engineering, Vol. 111, No. 4, p 758-765, July, 1985. 1 Fig, 4 Tab, 6 Ref. Office of Naval Research contract N00014-83-C-0182.

Descriptors: *California, *Tides, *Prediction, Forecasting, Coastal areas, Design criteria, Spring tides, Perigean tides, Tropic tides, Perihelion tides.

The combination of high tides and storm-induced waves were devastating to the coast of California during the winter of 1982-1983. Studies of sea level trends depend primarily on accumulated tide gage data over many years. Spring tides are large semi-daily tides that occur twice a month near f new moons when the lunar and solar attr are superimposed. Perigean tides are large s ly tides that occur monthly when the m closest to the earth. There are also tropic ti perihelion tides. Obviously, tides will be par ly high when spring tides coincide with p tides, tropic tides, perihelion and so forth. are presented which furnish monthly and extreme high tide predictions for 1983 t 2000. The predictions in these tables will pr measure of reassurance to those concerne California's coastal zone and should be u the design of protective structures and othe al engineering projects. Tremendous high ti not predicted for the remainder of this c Nevertheless, the highest tides in the perio 1990 will be slightly higher than those winter 1982-1983 due to enhancement of th nal lunar constituents in the 1986-1990 pe the moon's node cycle. (Baker-IVI)
W86-01100

ARSENIC, BARIUM, GERMANIUM, TI METHYLSULFIDE AND NUTRIENT BI CHEMISTRY IN CHARLOTTE HA FLORIDA, A PHOSPHORUS-ENRICHE TUARY,
Florida State Univ., Tallahassee. Dept. of ography.
For primary bibliographic entry see Field 5E
W86-01113

SEA-SURFACE MICROLAYER METAL RICHMENTS IN AN URBAN AND R BAY,
Battelle Pacific Northwest Labs., Sequim Marine Research Lab.
For primary bibliographic entry see Field 5E
W86-01114

FLUXES AND RESIDENCE TIMES O DROCARBONS IN THE COASTAL MEI RANEAN: HOW IMPORTANT ARE BIOTA,
International Lab. of Marine Radioa Monaco-Ville (Monaco).
For primary bibliographic entry see Field 5E
W86-01115

UPWELLING AND RIVER RUNOF SOURCES OF DISSOLVED NITROUS O TO THE ALSEA ESTUARY, OREGON,
Oregon State Univ., Corvallis. Coll. of Ocea phy.
M. A. de Angelis, and L. I. Gordon.
Estuarine, Coastal and Shelf Science, Vol. 2 4, p 375-386, April, 1985. 4 Fig, 4 Tab, 3 ONR contract N00014-79C-0004.

Descriptors: *Nitrous oxide, *Upwelling, *R *Alsea Estuary, *Oregon, Nitrates, Nitrites, fication, Floods, Estuarine environment, Dis gases.

Surface waters of Alsea Bay, an unpolluted on the Oregon coast, were analyzed for oxide, nitrate and nitrite on a weekly or bi basis during the summer of 1979. The estua found to be a variable source of N2O atmosphere. Large and rapid increases in th centrations of N2O, NO3(-), and NO2(-) oc at the beginning of the sampling period a attributed to the influx of nutrient-rich upw water into the estuary with the tide. The quent decline in concentrations of nitrate, and nitrous oxide over the remainder summer is attributed to a decrease in upw intensity, a decline in nitrification rates assimilatory nitrate reduction. Measurement trous oxide at six stations along the Alsea were also made in September and October and after the onset of the rainy season. Sa taken after flood conditions were establishe systematically 50% higher than pre-flood sa The data suggest that soil runoff results in el concentrations of N2O in rivers. (Autho stract)
W86-01117

: INCORPORATION IN A SALT
ECOSYSTEM,
of Natural Sciences of Philadelphia,
MD. Benedict Estuarine Research Lab.
ry bibliographic entry see Field 5B.
3

OF WIND, PHYTOPLANKTON AND
DISCONTINUITIES UPON AMMO-
TRIBUTIONS IN LIVERPOOL BAY,
Coll. of North Wales, Menai Bridge.
ence Labs.
. Beardall, D. Voltolina, and G.

Coastal and Shelf Science, Vol. 20, No.
75, April, 1985. 7 Fig, 1 Tab, 10 Ref.

s: *Fate of pollutants, *Ammonia,
Bay, *Wind, *Phytoplankton, *Destra-
Spatial distribution, Temporal distribu-
gen, Silicates, Nitrates, Seasonal varia-

temporal changes in distributions of
nd of physical and biological character-
ved in Liverpool Bay during a seasonal
cycle are presented. Ammonia concen-
not conform to the well defined sea-
in levels of silicate and nitrate; this led
ral variability in the relative contribu-
ite and ammonia to the total inorganic
ol. The gross changes in ammonia con-
and distributions in Liverpool Bay may
o the effects of three predominant fac-
the effect of wind upon the surface
culation during winter, the develop-
phytoplankton bloom during spring
ence or absence of a marked disconti-
or's abstract)

NS IN THE NATURAL ABUN-
15N IN ESTUARINE SUSPENDED
ATE MATTER: A SPECIFIC INDI-
BIOLOGICAL PROCESSING,
Marine Environmental Research,
ngland).
ns.
oastal and Shelf Science, Vol. 20, No.
April, 1985. 2 Fig, 21 Ref.

*Nitrogen radioisotopes, *Estuarine
*Suspended particles, *Particulate
mical reactions, Isotope studies, Cy-
ts, Catabolism, Anabolism, Particle
ese, Hydrocarbons.

tion of particle populations suspended
controlled not only by the intermix-
e materials of marine and riverine
so by significant in situ hydrodynamic
nd chemical and biological modifica-
asurement of the stable isotope ratios
(N-14:N-15) has made a significant
o knowledge of the sources and sinks
material in a variety of environ-
-14:N-15 ratio of suspended particu-
collected from the Tamar river estu-
st England, was determined to obtain
n the natural abundance of N-15 in
ree populations of particles, distin-
their N-15 content, were observed.
te that populations of estuarine parti-
rated by biological transformation in
he N-15 content of estuarine particles
ely reflect hydrodynamic mixing of
r and seawater source particulate ma-
cally mediated catabolism and anabo-
c nitrogen occurs in distinct regions
to distinct populations of particles.
ations have implications concerning
mical processes which occur in an
s removal of manganese and distribu-
olecular weight polyaromatic hydro-
ier-IVI)

M AND LONG-TERM INFLU-
THE IMMIGRATION OF POST-
NANA PRAWNS PENAEUS MER-

GUIENSIS, INTO A MANGROVE ESTUARY OF THE GULF OF CARPENTARIA, AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Cleveland (Australia). Marine Labs.
D. J. Staples, and D. J. Vance.
Marine Ecology - Progress Series, Vol. 23, No. 1, p 15-29, 1985. 11 Fig, 7 Tab, 40 Ref.

Descriptors: *Shrimp, *Estuarine environment, *Migration, *Fish migration, *Gulf of Carpentaria, *Australia, *Norman River estuary, Growth stages, Larval growth stage, Animal behavior, Physicochemical characteristics, Water temperature, Salinity, Nutrients, Seasonal variation.

Postlarval Penaeus merguiensis de Man were sampled regularly at the mouth of the Norman River estuary in the south-eastern Gulf of Carpentaria, Australia, from 1975 to 1979. A grid of stations up to 10 km offshore from the estuary mouth was also occupied over a 24 h period during November 1978. In these offshore stations, postlarvae migrated vertically in the water column in response to changes in tidal height, rising to near the surface just below low tide. Postlarvae entered the estuary throughout the flood tide with a peak in abundance occurring at the time of maximum current, regardless of time of day or night. During the monsoonal wet season (Dec-Mar), when estuary salinities were lower, postlarvae occurred deeper in the water column. Over the 4 yr of sampling, immigration on a day-to-day basis was extremely variable but a consistent spring-neap tidal cycle could be demonstrated. More postlarvae immigrated during the spring-tide period than during the neaps, although the pattern was complicated by a larger peak associated with every second spring tide (27.32 d). Although difficult to separate from tidal phase changes, lunar changes per se appeared to be less important than the relation between tidal phase changes and timing of moonset and moonrise. Immigration was restricted to the warmer months between October and April each year, with a large pulse of recruits occurring usually in spring (Oct-Nov) and a less consistent pulse occurring in autumn (Mar-May). Inter-annual variations were also large and it was suggested that these year-to-year differences were related to the amount of rainfall recorded during the previous wet season (9 mo earlier) and the associated changes in salinity, temperature, nutrients and abundances of adult prawns. Over larger time scales, both size and developmental stage (number rostral spines) were directly related to postlarval abundance. Thus, postlarvae tended to be larger and more well developed during spring and autumn of each year, and were also larger during years of high immigration rates. Increased growth as well as survival in years following good rainfall and enrichment is suggested. (Author's abstract)
W86-01125

NUTRIENT REGENERATION AND OXYGEN CONSUMPTION BY SEDIMENTS ALONG AN ESTUARINE SALINITY GRADIENT,
Maryland Univ., Solomons. Chesapeake Biological Lab.
W. R. Boynton, and W. M. Kemp.
Marine Ecology - Progress Series, Vol. 23, No. 1, p 45-55, 1985. 7 Fig, 1 Tab, 65 Ref.

Descriptors: *Cycling nutrients, *Oxygen demand, *Sediments, *Estuarine environment, *Chesapeake Bay, *Sediment-water interfaces, Spatial distribution, Environmental gradient, Salinity gradient, Phosphorus, Nitrates, Nitrogen, Ammonium.

Nutrient fluxes and oxygen consumption (SOD) across the sediment-water interface were measured in situ along with vertical profiles of dissolved and particulate-phase nutrients in sediments and overlying water at 8 locations along the salinity gradient of Chesapeake Bay during spring and summer. Strong spatial and temporal patterns were evident. Highest rates of sediment NH4(+) regeneration and SOD occurred in summer at mid-salinity (12 to 17%) stations. Sediment fluxes of dissolved inorganic phosphorus (DIP) were always low, possibly due to relatively oxidized conditions in surficial sediments. Nitrate (NO3(-)) fluxes generally were directed into the sediments in spring and from the sediments during summer, and in both seasons fluxes were proportional to NO3(-) concentrations in overlying waters. Seasonal shifts in sediment O:N flux ratios suggest that denitrification may have been important in spring but not summer. Significant relations were inferred between C:N:P composition of suspended materials and surficial sediments and the magnitude and direction of sediment-water fluxes. Although accretion of particulate nitrogen in sediments was less than 6% of NH4(+) regeneration in the lower bay, it was similar to rates of NH4(+) flux in the low salinity region, suggesting that burial represents a significant sink for N in some estuarine zones. SOD constituted an important term in watercolumn O2 budgets at all stations (16-50% of total respiration), and sediment regeneration of NH4(+) was capable of supplying 13 to 40% of calculated phytoplankton N requirement, being more important during the summer period of higher productivity. (Author's abstract)
W86-01126

HYDROLOGY AND CHANGES IN THE NUTRIENTS AND PHYTOPLANKTON LEVELS IN GOAT ISLAND BAY, NORTHERN NEW ZEALAND,
Auckland Univ., Leigh (New Zealand). Marine Research Lab.
N. J. Taylor, and F. J. Taylor.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 173-186, 1985. 12 Fig, 2 Tab, 15 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Estuarine environment, *Goat Island Bay, *New Zealand, *Bays, Solar radiation, Nitrates, Land use, Environmental effects, Ammonia.

Quantitative phytoplankton samples were taken fortnightly from four stations in Goat Island Bay, northern New Zealand, and from one station in the inflowing creek, over the period June 1981 to August 1982. The nutrient levels at each station were also measured. The phytoplankton was similar in quantity and composition to that found in an earlier survey in 1966-69. No correlations were found between the phytoplankton densities and the nutrient levels. Significant correlations of the phytoplankton were obtained with radiation levels. This indicates that the phytoplankton populations are limited by light intensity and not by nutrient availability. The only significant change was a doubling of the dissolved nitrate levels in the sea, which appeared to be related to increased nitrate levels in the freshwater creek. It is suggested that the increase is due to an increase in the farming and recreational use of the catchment area. Nutrient levels in the creek were, except for ammonia, higher than in the sea. Some evidence is presented that the increase in the nitrate levels in the sea was associated with increased nitrate levels in the creek. (Collier-IVI)
W86-01127

EXPERIMENTAL STUDIES ON THE SUSCEPTIBILITY OF FRESHWATER PHYTOPLANKTON TO VARIATION OF SALINITY IN THE FJORD OF SAGUENAY (ST. LAWRENCE ESTUARY), CANADA (ETUDES EXPERIMENTALLES SUR LA SENSIBILITE DU PHYTOPLANCTON D'EAU DOUCE AUX VARIATIONS DE SALINITE DANS LE FJORD DU SAGUENAY (ESTUAIRE DU ST-LAURENT), CANADA),
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
S. Cloutier, and R. Cote.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 187-201, 1985. 12 Fig, 33 Ref.

Descriptors: *Phytoplankton, *Salinity, *Fjord of Saguenay, *St. Lawrence Estuary, *Quebec, Diatoms, Stress, Seasonal variation, Environmental gradients.

The Saguenay Fjord is characterized by very high run-offs. The annual flow varies between 1200 and 4200 cu m/s. During the summer the surface salinity shows a sharp horizontal gradient (from 1 0/00 to 20 0/00). The surface phytoplankton, mainly

freshwater and even some euryhaline species, is submitted to salinity stress. Continuous culture experiments were conducted to study the susceptibility of this freshwater phytoplankton under different salinity conditions. Some pennate diatoms (dominant group) are found as relatively tolerant to salinity. Microflagellates have been found to be resistant to salinity up to 26 0/00. Chlorophyll concentrations and rates of primary production of those organisms are as high as those of the control. (Author's abstract)
W86-01128

TWO-DIMENSIONAL CALCULATION OF TIDE BY EXPLICIT WEIGHTED RESIDUAL METHOD - I SHIBUSHI BAY,
Kagoshima Univ. (Japan). Faculty of Fisheries.
H. Kikukawa, and I. Seo.
Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 33, No. 1, p 13-21, December, 1984. 12 Fig, 9 Ref.

Descriptors: *Tides, *Shibushi Bay, *Japan, *Predictions, *Biro Island, Tidal hydraulics, Winds, Water currents, Bays.

A two-dimensional explicit weighted residual method is applied to estimate the tidal residual flow of Shibushi Bay. Only the M sub 2 tide is taken into account. The effects of the ocean current, the wind stress, the river current, the bottom stress etc. were not considered. The water mass is found to be well conserved after the 7 periods of calculations. There appear in the tidal residual flow a clockwise circulation around Biro Island and an anti-clockwise flow at the south of Biro Island. In the time averaged equation of momentum, the advective term and the gravity term are balanced at the inner part of the bay; at the outer part of the bay, the advective term, the gravity term and the Coriolis term are balanced. The viscous term is only important around Biro Island. The phase delay of the water surface elevation is found to be negligible all over the bay. (Author's abstract)
W86-01144

SEASONAL CHANGES IN THE GENERIC COMPOSITION OF HETEROTROPHIC BACTERIA IN SEAWATER OF KAGOSHIMA BAY (IN JAPANESE),
Kagoshima Univ. (Japan). Faculty of Fisheries.
For primary bibliographic entry see Field 5B.
W86-01148

USE OF THE RB/K RATIO TO EVALUATE POTASSIUM NUTRITION OF PEATLANDS,
Minnesota Univ., St. Paul. Dept. of Soil Science.
C. G. Buttleman, and D. F. Grigal.
Oikos, Vol. 44, No. 2, p 253-256, April, 1985. 1 Fig, 2 Tab, 14 Ref. NSF grant DEB 7922142, and Minnesota Agricultural Experiment Station project 25-54.

Descriptors: *Rubidium, *Potassium, *Peatlands, *Peatbogs, *Minnesota, Nutrients, Vegetation, Plant physiology, Bogs, Mosses, Wetlands.

The Rb/K ratio was determined in two classes of forested peatlands, raised and perched bogs, in northern Minnesota. These two classes of bogs are deficient in K, but differ somewhat in degree of deficiency and in source of K. Differentials were sought in the Rb/K ratio between the two classes of bogs. The ratio was significantly lower in the living vascular vegetation on the raised bogs, but significantly higher in the deep peat in those bogs. There was no difference in the ratio in the living moss and shallow peat between bogs in the two classes. The ratio was apparently affected by biological selectivity in K uptake by plants under low-K conditions. These results raise questions concerning use of this ratio in ecosytem studies. (Collier-IVI)
W86-01164

ENHANCEMENT OF MARINE PRIMARY PRODUCTION BY NITROGEN-ENRICHED ACID RAIN,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
For primary bibliographic entry see Field 5C.
W86-01172

ROLE OF PHYTOPLANKTON IN THE DISSOLVED OXYGEN BUDGET OF A STRATIFIED ESTUARY,
Southern Water Authority, Otterbourne (England). Resources Planning Lab.
P. G. Soulsby, M. Mollowney, G. Marsh, and D. Lowthion.
Water Science and Technology, Vol. 17, No. 4/5, p 745-756, 1985. 9 Fig, 20 Ref.

Descriptors: *Test Estuary, *England, *Mesodinium, *Eutrophication, *Dissolved oxygen, Phytoplankton, Photosynthesis, Vertical migration, Mathematical models, Stratification, Estuarine environment, Chlorophyll a.

The Test Estuary situated at the head of Southamption Water, southern England was identified as likely to be subject to a series of developments which would require careful consideration of their impact on its water quality. Dissolved oxygen was identified as the most important parameter for consideration since the estuary carries a substantial run of salmon each summer. In the Test Estuary, the lowest dissolved oxygen levels followed a mid summer phytoplankton bloom, dominated by the ciliate Mesodinium rubrum. A numerical model was developed to calculate the water circulation, vertical mixing, dissolved oxygen and chlorophyll a. To obtain agreement between observed and predicted dissolved oxygen and chlorophyll a distributions, it was necessary to simulate a unique characteristic, the diurnal vertical migration of Mesodinium. Mesodinium is extremely motile; during the day the main concentration of Mesodinium is found between 1 and 3 m, but a substantial downward movement occurs just before dusk and within 30 minutes the bulk of the population is contained in the botton third of the depth. This position is maintained throughout the hours of darkness, but prior to dawn, a substantial movement towards the surface occurs. During the bloom period supersaturated oxygen levels are maintained in the surface layers. The bulk of the nighttime respiration takes place in the bottom layers of the water column which do not receive the compensating photosynthetic oxygen. This may lead to a depletion of the oxygen from the bottom layers as the bloom progresses. (Moore-IVI)
W86-01197

BEHAVIOUR OF SUSPENDED SEDIMENTS AND MUDS IN AN ESTUARY,
Iwate Univ., Morioka (Japan). Dept. of Civil Engineering.
T. Umita, T. Kusuda, Y. Awaya, M. Onuma, and T. Futawatari.
Water Science and Technology, Vol. 17, No. 6/7, p 915-927, 1985. 19 Fig, 2 Tab, 9 Ref.

Descriptors: *Suspended sediments, *Mud, *Estuaries, Shear stress, Tidal effects, Sediment erosion, Sedimentation, Flocculation, Simulation, Model studies.

The fundamental behavior of suspended sediments and muds was investigated using an annular flume with the condition of cyclically changed shear stress. The results from two series of experiments showed that particle sizes which participate in the variation of suspended sediments were restricted to smaller sizes of the material. It was also found that the cyclically steady state was finally attained with respect to the suspended sediments as the tidal cycle repeated. In that state the suspended sediments were subject to three phenomena: erosion; deposition with dispersed state; and deposition with flocculation. A simple model of the suspended sediments in an estuary was developed and its behavior in a model estuary was simulated by using the fluxes of erosion and deposition in the experiment. That model well described the variation of the suspended sediments and muds. (Author's abstract)
W86-01231

MODELLING OF OXYGEN DEPLETION COASTAL WATERS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
For primary bibliographic entry see Field 5C.
W86-01235

ROLE FOR A SIMPLE DISCRETE-T MODEL TO DESCRIBE DISPERSION IN ESTUARY,
Sydney Univ. (Australia). Dept. of Chemical E neering.
T. Wood.
Water Science and Technology, Vol. 17, No. p 991-1000, 1985. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Estuaries, *Dispersion, *Mathe cal models, Tidal effects, Salinity, Model stu Hawkesbury River, Australia, Model stu River flow.

A simple discrete-time model is proposed to scribe dispersion in an estuary, based on tida changes between neighboring segments. A pr dure for parameter estimation and model valida is described which can be implemented wi minimum of field measurements; and the app tion of the model is demonstrated with data lected from the Hawkesbury River system, Sydney, Australia. The results indicate that modelling procedure described is capable of ducing useful predictions of the response of sal distribution to changes in fresh water input tidal amplitude. The method could be most u in circumstances where limitations on experim resources preclude the undertaking of a more tailed investigation. (Author's abstract)
W86-01237

TIDAL VARIATION OF SALT FLUX AND PERSION IN A POLLUTED ESTUARY,
Newcastle upon Tyne Univ. (England). Dep Civil Engineering.
J. K. Park, and A. James.
Water Science and Technology, Vol. 17, No. p 1001-1015, 1985. 10 Fig, 6 Tab, 18 Ref.

Descriptors: *Salinity, *Dispersion, *Tidal eff *Estuaries, Tyne Estuary, England, Velo River flow, Tidal currents, Vertical shear, M studies, Water quality.

Velocity and salinity data collected during summer of 1983 in the Tyne estuary (England used to investigate the dominant mechanism the flux of salt and dispersion. The instantan salt flux arises mainly from the combinatio velocity fluctuation with the tidal mean sali and the instantaneous dispersion results almos tirely from the combination of vertical oscilla velocity and steady salinity. Of the net do stream salt flux, 92.4% is accounted for by river discharge. The non-tidal drift appears to most importance in the net upstream salt flux. estuary has a strong vertical salinity gradient due to the strong secondary flow, has a uni transverse gradient; thus, the dominant facto the longitudinal dispersion arises from the ver shear in the oscillatory tidal current. The dis sion coefficient is highly time-dependent within tidal cycle as well as a function of distance. importance of time-varying longitudinal dispe coefficients are demonstrated in a water qu model by using the sensitivity analysis. (Aut abstract)
W86-01238

NITROGEN TRANSFORMATIONS IN BALTIC PROPER: DENITRIFICATION CO TERACTS EUTROPHICATION,
Goeteborg Univ. (Sweden). Dept. of Microb gy.
For primary bibliographic entry see Field 5B.
W86-01278

creased by reducing tillage, by avoiding the rapid wetting associated with flood irrigation and by the addition of organic matter. However, there has been no increase in rooting depth or activity of maize crops, as indicated by soil water extraction patterns and midday leaf water potential data, in response to the treatments imposed. However, lucerne rapidly developed an active root system, deeper in the profile than maize. This deeper root system increased the soil water supply for lucerne by approximately 50 mm. (Author's abstract)
W86-01032

WATER RETENTION, TRANSMISSION AND CONTACT CHARACTERISTICS OF LUDAS SAND AS INFLUENCED BY FARMYARD MANURE,
Haryana Agricultural Univ., Hissar (India). Dept. of Soils.
S. Kumar, R. S. Malik, and I. S. Dahiya.
Australian Journal of Soil Research, Vol. 22, No. 3, p 253-259, 1984. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Sand, *Water retention, *Transmission, *Manure, Permeability coefficient, Contact angle, Irrigation effects, Soil water.

A low retention capacity for water and a high percolation rate are the two major soil physical problems encountered in managing sandy soils. The soil-water contact property is one of the important factors influencing the infiltration of water into soils. Experiments were conducted in which small cylinders were filled to a depth of 20 cm with a sandy soil to which farmyard manure had been added up to a maximum rate equivalent to 846 t/ha. The cylinders were set in the ground and kept moist. At the end of 10 months samples were taken for measuring water retention and saturated hydraulic conductivity as well as the rate of horizontal infiltration for 0.01 M CaCl2 and alcohol. An apparent contact angle was calculated from the last two measurements. Manure application caused a progressive increase in the volume of water retained at a given suction, together with a small increase in available water. Hydraulic conductivity was decreased. Cumulative horizontal infiltration of 0.01 M CaCl2 decreased markedly with increase in manure applied. This decrease is attributed mainly to an increase in the contact angle. Increased water retention at all pressure potentials with manure applications means an increased water storage capacity of the sand. Decreased hydraulic conductivity, penetration coefficient and infiltration rate with manure application mean coverage of relatively larger areas under surface irrigation with a given quantity of irrigation water in improved sand as compared to control sand. (Moore-IVI)
W86-01033

OPTIMIZATION OF A SPATIALLY VARIABLE RESOURCE: AN ILLUSTRATION FOR IRRIGATED CROPS,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
E. Feinerman, E. Bresler, and G. Dagan.
Water Resources Research, Vol. 21, No. 6, p 793-800, June, 1985. 2 Fig, 2 Tab. 26 Ref, 3 Append.

Descriptors: *Optimization, *Crop yield, *Irrigation effects, Corn, Decision making, Water supply, Spatial distribution, Variability.

Economic optimization of a resource which is space dependent and displays irregular spatial variation was investigated. The resource (yield) of an entire field is regarded as a random variable which depends on a random function on the one hand, and a control variable on the other hand. The study focuses on the question of how economically efficient levels of relevant control variables may vary as a function of random spatial variability of resources, taking into account the decision maker's attitude to risk. A general approach to cope with the above question is developed, and the effects of uncertainty on the levels of the optimal control variables are investigated by comparing a deterministic case with two uncertainty levels of decision making: risk neutral and risk averse. Following the general methodology, expectation value and variance of average yield are first approximated by Taylor series expansion and then closed-form solutions are obtained for a specific, exponential, yield production function. Subsequently, the general analysis is illustrated for the example of irrigated corn, the only control variable being water quantity, and with corp yield a spatial random function in the plane. The results suggest that the impact of random soil properties on optimum level of water application might be substantial. Hence it is generally worthwhile to account for spatial variability in optimizing level of irrigation or similar control variables. (Author's abstract)
W86-01070

UNCERTAINTY ANALYSIS OF WATER RESOURCE USE IN DHORA RESERVOIR COMMAND AREA,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Economics.
J. Kumar, and V. H. Sharma.
Indian Journal of Power and River Valley Development, Vol. 33, No. 11, p 397-400, November, 1983. 2 Tab.

Descriptors: *Dhora Reservoir command area, *India, *Water management, Rainfall, Crop yield, Irrigation efficiency, Nitrogen, Crop production, Rice, Wheat, Sugarcane.

The Dhora Reservoir command area comprises 42138 hectares in the districts of Nainita, Bareilly and Rampur (India). The objectives of the present study were to find out probability distributions of fortnightly rainfall; to estimate fortnightly inflow of water into Dhora Reservoir over time; to prepare an optimal water resource plan for the Dhora Reservoir command area at different probable water suppy levels; and to find out optimum long run water resource plan for the Dhora Reservoir command area. The present use of nitrogen in the command area is concluded to be below optimal levels. It should be increased to three times that of the existing level in order to obtain maximum crop production with the available irrigation water. According to the long run plan developed on the basis of uncertainty analysis with respect to rainfall and, in turn, availability of water in Dhora Reservoir, the area located in the Dhora command to paddy, wheat, sugarcane, 34.70, 35.90, and 24.52% of total cropped area respectively, should be changed to 35.04, 35.39, and 25.00% of the cropped area respectively. The local varieties of paddy should be grown in the entire paddy area if the supply level of nitrogen remains at the existing level. At increased supply levels of nitrogen, the entire paddy area should be occupied by high yielding varieties. The nitrogen and irrigation water used for different crops should be adjusted over time, after observing the actual rainfall situation. The adoption of long run plans along with adjustments in cultural practices is expected to increase crop production in the area by 46.99% at existing nitrogen supply levels and by 99.27% without nitrogen constraint over the existing level of production. (Baker-IVI)
W86-01220

AGRICULTURAL AND ECOLOGICAL FEATURES IN THE EXPLOITATION OF IRRIGATED GROUNDS AND MEANS OF INCREASING THEIR PRODUCTIVITY (AGROEKOLOGICHESKIE OSOBENNOSTI ISPOL'ZOVANIYA OROSHAEMYKH POCHV I PUTI POVYSHENIYA IKH PROIZVODITEL'NOSTI),
M. P. Babayev.
Izvestiya Akademii Nauk Azerbaydzhanskoy SSR Seriya Biologicheskikh Nauk, No. 3, p 29-34, 1983. 1 Fig, 13 Ref.

Descriptors: *Agriculture, *Irrigation practices, *Kura-Araxin Valley, *Azerbaijan S.S.R., Irrigation water, Fertilization, Cultivation, Crop production.

To improve the productivity of the soils in the Kura-Araxin valley of Azerbaijan systematic investigations of the irrigational areas should be carried out. Irrigational soils with similar ecologic features should be categorized for appropriate exploitation.

In addition to the usual agricultural procedures, surveillance of the quality of irrigational waters, including suitable purification of wastewaters and application of local fertilizers, should be focused on. Long range cultivation under irrigational conditions should generate fertile soils with an increased productivity of cotton, grain, rice and perennial grass by 60-70%. (Erdelyi-IVI)
W86-01258

INFILTRATION FROM A TRICKLE SOURCE IN A HETEROGENEOUS SOIL MEDIUM,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2G.
W86-01295

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

INCREASE OF THE EFFECTIVENESS OF USING THE HYDROPOWER RESOURCES OF THE ENISEI RIVER,
For primary bibliographic entry see Field 6B.
W86-00986

STOCHASTIC OPTIMIZATION OF A MULTIRESERVOIR HYDROELECTRIC SYSTEM: A DECOMPOSITION APPROACH,
Centro de Pesquisas de Energia Electrica, Rio de Janeiro (Brazil).
M. V. F. Pereira, and L. M. V. G. Pinto.
Water Resources Research, Vol. 21, No. 6, p 779-792, June, 1985. 14 Fig, 2 Tab, 33 Ref, 1 Append.

Descriptors: *Stochastic process, *Optimization, *Multireservoir networks, Hydroelectric power, Algorithms, Reservoirs, Electric powerplants, Cost analysis.

The objectives of the optimal operation of a hydrothermal generating system is to determine a generation schedule for each plant in the system that minimizes the expected operation cost for the planning period. The availability of limited amounts of hydroelectric energy, in the form of stored water in the system reservoirs, makes the optimal operation problem very complex because it creates a link between an operating decision in a given stage and the future consequences of this decision. A computational scheme that is able to determine at each stage the most economical generation decision for each plant of a hydrothermal system is presented. The algorithm is based on the stochastic extension of Benders decomposition and can be implemented from already existing operation models. The results can be used in the weekly or monthly generation scheduling activities in real-time operation. The algorithm supplies at each iteration an upper and lower bound to the optimal solution, allowing an efficient trade-off between computational effort and accuracy. The algorithm can accomodate any kind of stream-flow model because the transition probabilities at the bifurcations can be specified at will. A case study with four reservoirs was used to illustrate in detail the application of the algorithm. Its performance was further assessed with an example with 37 reservoirs. (Moore-IVI)
W86-01069

WATER QUALITY AND REGIONAL WATER SUPPLY PLANNING,
Corps of Engineers, San Francisco, CA. South Pacific Div.
A. J. Lauwaert.
Journal of Water Resources Planning and Management, Vol. 111, No. 3, p 253-267, July, 1985. 1 Fig, 6 Tab, 4 Ref, 1 Append.

Descriptors: *Florida, *Lake Okeechobee, *St. Lucie County, *Water quality control, *Water supply development, Irrigation water, Runoff, Phosphorus removal, Flow-ways, Canals.

Canal 131 was intended to convey irrigation water supply to Martin and St. Lucie counties in Florida. The canal would be a direct access to Lake Okeechobee and would connect the lake to existing Canals 23-25 in St. Lucie County. Backflow would return surplus rainfall runoff to Lake Okeechobee from the St. Lucie County canals. The Canal 131 Flow-way Plan provides a flow-way area north of Canal 131 where surplus runoff could be diverted and detained. The intent of the flow-way plan is to create a seasonal wetland community for the removal of phosphorus from backflow into the lake. A method for sizing a flow-way to remove phosphorus from surplus rainfall runoff is presented. A 6.65 sq mi (17.22 sq km) flow-way with minimal additional management techniques is economically and environmentally desirable. The plan will protect groundwater supplies by returning captured surface runoff stored in Lake Okeechobee for irrigation water supply and reduce the need for obtaining irrigation requirements from groundwater sources. Diverting nontidal flows, which previously carried runoff into the St. Lucie Estuary, will improve surface water quality in the estuary, enhancing fish habitat. (Moore-IVI)
W86-01101

OPERATION AND EFFICIENCY OF AUTOMATICALLY OPERATING WEIR STRUCTURES - A CONTRIBUTION TO CLEANER WATERS,
Technische Univ. Braunschweig (Germany, F.R.). Leichtweiss-Inst. fuer Wasserbau und Grundbau.
E. Macke.
Water Science and Technology, Vol. 17, No. 6/7, p 1211-1221, 1985. 8 Fig, 6 Ref.

Descriptors: *Storm runoff, *Weirs, *Automation, *Storm sewers, Water quality control, Storm wastewater, Impounding head, Combined sewer overflows.

The automatically operating weir structures presented are simple, largely maintenance-free structures which, when used as control elements in storm overflows, offer considerable advantages over the fixed weir sills. Irrespective of the intensity of rainfalls, these weirs do not discharge any surplus water into the receiving water, unless a maximum possible water level has been reached, which is then maintained at a virtually constant level until the floods subside. The maximum possible water level, the so-called impounding head, will be determined in such a way that, on the one hand, the sewer capacity will be fully utilized, and, on the other, any undesirable backwater in the sewer system can be precluded. The weirs are not only suited for installation in new structures, but may also be integrated in existing ones. Time and cost consuming constructional measures can be dispensed with, as the weirs, owing to their configuration (they are composed of individual segments), can be passed through the existing manholes. They allow considerable additional sewer capacities to be activated, in particular in low-head sewer systems, so that the installation of high-cost retaining basins, which normally require a high degree of maintenance, can either be limited or dispensed with altogether. As the receiving water will be affected only when a given impounding head has been reached, the amount of combined sewage discharged can be reduced to a minimum. (Author's abstract)
W86-01254

STORMWATER MANAGEMENT EMPHASIZES SOFT IMPROVEMENTS,
Fort Collins Stormwater Utility, CO.
M. Engomoen.
Public Works, Vol. 16, No. 7, p 66-67, July, 1985. 3 Fig.

Descriptors: *Drainage systems, *Fort Collins, *Colorado, *Storm runoff, Management, Planning, Design criteria, Land use, Drainage canals, Surface drainage, Grassed waterways.

The focus of the Fort Collins (Colorado) stormwater utility is the identification and management of storm drainage systems. These systems wide range of individual elements incl features such as natural drainageways, c rivers, man-made lakes, canals, and open channels. By placing emphasis on d cepts for soft drainage features before de occurs, major design flows can be deter right of way needs identified well in a other land planning activities. Beyond th ic and open space advantages of soft ments, the use of grass-lined channels tion areas offers some environmental Basin master plans also identify the need hard drainage improvements. Fort Col mittment to soft improvements is illus recent changes in the storm drainage ma program. Designing and constructing na terways, grasslined and landscaped open and detention areas are only the first st tive annual maintenance must be a part o The committment to soft improvements ed in improved maintenance procedures a standards and it has triggered increased tion with other city departments to open space and recreational use of drai (Baker-IVI)
W86-01315

4B. Groundwater Managemen

QUANTITATIVE ANALYSIS OF THE HYDROTHERMAL SYSTEM, NORTRAL CALIFORNIA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field
W86-01077

GROUND-WATER RESERVOIR OPE FOR DROUGHT MANAGEMENT,
Roger Williams Coll., Bristol, RI. Dept Engineering.
R. S. Gupta, and A. S. Goodman.
Journal of Water Resources Planning and ment, Vol. 111, No. 3, p 303-320, July, 19 5 Tab, 14 Ref, 1 Append.

Descriptors: *Drought management, *Gr er reservoirs, Groundwater managemen studies, Groundwater movement, Geoh Conjunctive use, Infiltration, Wells, Cutoff cores, Hydrodynamics.

A hydrodynamic groundwater model is with a multi-level management model to a composite model for investigating grou reservoir operation for drought manage hydrodynamic model solves the three-di groundwater flow equation by the finite method. A U.S. Geological Survey Mo extensions is used for this purpose. For drogeological conditions, the manageme assists the planner to design a system for ing low streamflows according to stipula supply requirements, by: (1) Arranging within each unit of a multiaquifer syste establishing the withdrawal pattern for th Sensitivity analyses are made of the p pertaining to the conjunctive use of wat plying the model to the Mashipacong Is in the Delaware Basin. The studies con hydrogeological properties of the aqu streambed, artificial measures to reduce infiltration, and arrangements of wells a ing schedules. Among the infiltration measures studied, a vertical semi-pervious tending through the entire thickness of th can reduce losses from over 60% to less t Such a cutoff core, constructed by th trenching process, may be economically (Author's abstract)
W86-01105

RESPONSE OF GROUNDWATER LEV RAINFALL AND TO LEAF GROW FARM PLANTATIONS NEAR SALT SE
Commonwealth Scientific and Industrial Organization, Wembley (Australia). Groundwater Research.
For primary bibliographic entry see Field

stoneflies (Spaniocera, Zelandobius, Austroperla) ingested mainly allochthonous detritus including fragments of leaf and wood. Insect larvae from stream 214 contained variable amounts of filamentous algae and/or diatoms. Stable carbon isotope ratios (C-13/C-12 expressed as delta C-13) of fine particulate organic matter from all 6 streams ranged from -27.4 to - 28.4%, indicating a primarily terrestrial origin. Delta carbon-13 values were comparable for closed-canopy streams, but insects, including predators, from open-canopy streams were relatively depleted in C-13, and in stream 214 the values approximated that for algae (-33.3%) from that stream. (Rochester-IVI)
W86-00927

SIMULATOR FOR WATER RESOURCES IN RURAL BASINS,
Agricultural Research Service, Temple, TX.
For primary bibliographic entry see Field 2A.
W86-01049

DETERMINATION OF URBAN FLOOD DAMAGES,
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 6E.
W86-01102

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DEVELOPMENT AND USE OF AN EMPIRICAL MODEL FOR DISSOLVED OXYGEN IN THE RIVER DON, ABERDEENSHIRE,
Water Research Centre, Stevenage (England).
J. S. Alabaster, J. C. Allan, and C. W. M. Sim.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2244-2247, 1985. 2 Tab, 9 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *River Don, *Scotland, Biological oxygen demand, Benthos, Nutrients, Streamflow.

Dissolved oxygen (DO) levels in relation to biochemical oxygen demand (BOD) loading were predicted for the lower River Don (Scotland) using an equation derived from Streeter and Phelps (1925). During September 1981 the flow of the river was close to the 95th percentile value and the BOD load remained relatively constant; validation of the model was carried out for this period. A multiple regression of the BOD decay coefficient (per km) (k sub 1) on flow and temperature explained 87% of the variation in k sub 1. Splitting the data within the different flow bands to distinguish those that were associated with BOD loads that were either higher or lower than averaged showed that both k sub 1 and the respiration rate (oxygen demand) of growths attached to the bed of the stream (g/cu m/km) (R) increased with increase in load. The predicted DO for the validation period at one station was 5.7 mg/l; the observed DO was 5.1 mg/l. The observed BOD was slightly (1.3 mg/l) higher than predicted and the values of k sub 1 and R were also somewhat higher than those calculated for the years 1973-79. There was a reduction in k sub 1 with increase in flow, although low temperature coinciding with high flow was also a minor contributing factor. Loads also influenced k sub 1. The maximum values of R occurred not at the highest flows (7.6 and 8.7 cu m/sec), but at 6.6 cu m/sec, perhaps partly because low water velocity at low flow reduced the mass-flow of nutrients below that limiting the growth of benthic organisms. (Rochester-IVI)
W86-00937

ECOLOGICAL WATER QUALITY POLICY: AN ATTEMPT AT CONCEPT CLARIFICATION AND A PLEA FOR THE USE OF BIOLOGICAL ECOSYSTEM PARAMETERS,
Ministerie van Welzijn, Volksgezondheid, en Cultuur, Amsterdam (Netherlands).
A. Goedmakers.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2277-2280, 1985. 10 Ref.

Descriptors: *Ecology, *Ecological effects, *Water quality criteria, Water quality standards, Policy making, Physicochemical characteristics, Water chemistry, Indicators, Bioindicators.

Definitions, parameters, and standards for an ecological water quality policy are discussed. An ecological water quality policy is a water quality policy based on the ecosystem, and is not necessarily directed toward improvement of water quality as it would be defined for human health or industrial use as is currently done. Ecological parameters are those that describe the ecosytem; physical, chemical, or biological parameters may be employed in setting ecological standards. Although biological parameters have not been as accepted in standard setting as physico-chemical ones, their properties for description of the ecosystem make them indispensable for an ecological water quality policy. Biological parameters lack many of the technical problems associated with physico-chemical standards, but it is unlikely that one biological standard will be universally applicable, hence a differentiated approach to standard setting will be necessary. (Rochester-IVI)
W86-00941

USING SEVERAL INDICES FOR BIOLOGICAL ASSESSMENT OF WATER QUALITY IN RUNNING WATER,
Limburg Water Pollution Control Authority, Roermond (Netherlands).
H. H. Tolkamp.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2281-2286, 1985. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Bioindicators, *Water quality, *River Geul, *Netherlands, Assessments, Statistical analysis, Species distribution, Species composition.

Samples (113) were collected in the drainage area of the River Geul (The Netherlands), and 88 of them were used in a comparison of various biological indices for water quality assessment. The Trent Biotic Index, Indice Biotique (French Biotic Index), Indice de Qualite Biologique Globale, the Chandler score, Biological Monitoring Working Pary Score, Saprobic Index, Quality Index (K sub 135), Expanded Biotic Index, and modifications of some of these indices were all calculated for all samples, which had been obtained from lowland, upland, and spring or small stream locations. The resulting figures for each index were divided into 10 classes so that frequency histograms of the same number of intervals were obtained for all indices. Most of the sites used in the calculations had fairly good to good water quality; several indices were clearly inadequate for identifying the pollution level at the sites studied. Several gave an underestimation of water quality, and at least one (K-index) appeared to overestimate the quality of the stream waters. The use of 10-class histograms does not provide a means of obtaining absolute pollution levels, but creates a means of comparison from one sample to another. To know which level of water quality is the best achievable for each stream reach, it is necessary to know what the natural running water community for that site would look like. Most biotic indices or saprobic indices cannot be translated into each other. The right assessment system should be chosen, fit to be used under local conditions, with a well-defined achievable maximum or pollutional range. (Rochester-IVI)
W86-00942

USE OF BACTERIA ATTACHED TO SUBMERGED MACROPHYTES AND GLASS SLIDES AS INDICATORS OF AN INCREASING WATER POLLUTION,
Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Bodenkunde und Standortslehre.
For primary bibliographic entry see Field 7B.
W86-00943

CHARACTERIZATION OF DIFFERENTLY POLLUTED PONDS BY SUBMERGED MACROPHYTES AND VARIOUS DENITRIFYING BACTERIA,
Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Bodenkunde und Standortslehre.
F. Schmider, and J. C. G. Ottow.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2303-2308, 1985. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Bioindicators, *Aquatic plants, *Bacteria, *Germany (Federal Republic), *Nitrogen removal, Species distribution, Indicators, Species composition, Microorganisms.

Submerged macrophytes and denitrifying bacteria composition reflected pollutional level at four sites in West Germany. An oligotrophic well near Stuttgart-Busnau and three, increasingly eutrophic, natural ponds in the Rhine Valley (Baggersee - oligotrophic, Festungsgraben - mesotrophic, and Koenigsee - eutrophic) were chosen. Chara vulgaris, Potamogeton nodosus, and P. trichoides occurred only in Baggersee, whereas Ceratophyllum demersum, Hippuris vulgaris, Nuphar lutea, and Utricularia vulgaris were found abundantly in the mesotrophic and eutrophic ponds. Hottonia palustris and Hydrocharis morsus-ranae were found only in Koenigsee. In Koenigsee prototrophic denitrifying organisms (Acinetobacter-Moraxella-Alcaligenes spp) constitutued the main part of the denitrifying flora. Altogether, 92 denitrifying bacteria were isolated, and the qualitative determination confirmed the quantitative results. Pseudomonas fluorescens and Vibrio spp were more frequent in the oligotrophic well and Baggersee, whereas P. alcaligenes and Aeromonas spp were mainly distributed in Koenigsee. Assessment of rapid changes of pollution level by chemical parameters should be supplemented by bio-indicators, such as the submerged macrophyte and microbial group analyses used here. (Rochester-IVI)
W86-00944

DIATOM COMMUNITIES OF THE POLLUTED RIVERS OF CENTRAL POLAND (LES COMMUNAUTES DES DIATOMEES DANS LES RIVIERES POLLUEES DE LA POLOGNE CENTRALE),
Lodz Univ. (Poland). Inst. of Environmental Biology.
For primary bibliographic entry see Field 5C.
W86-00947

SEDIMENT AS A RECORD OF COPPER POLLUTION IN LAKE ORTA,
Istituto di Ricerca sulle Acque, Milan (Italy). Reparto Sperimentale di Idrobiologia Applicata.
For primary bibliographic entry see Field 5B.
W86-00958

USE OF AQUATIC BRYOPHYTES TO MONITOR HEAVY METALS POLLUTION OF FRESHWATERS AS ILLUSTRATED BY CASE STUDIES,
Metz Univ. (France). Lab. d'Ecologie.
For primary bibliographic entry see Field 7B.
W86-00962

USE OF LIMNOCORRALS FOR PESTICIDE TOXICITY STUDIES: EFFECT ON ZOOPLANKTON COMPOSITION AND DYNAMICS,
Tel-Aviv Univ. (Israel). Inst. for Nature Preservation Research.
A. Gasith, and A. S. Perry.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2432-2436, March, 1985. 3 Fig, 1 Tab, 5 Ref. FAO/IAEA Contract No. 1724/R4/SD.

Descriptors: *Limnocorrals, *Bioindicators, *Zooplankton, *Pesticide toxicity, Pesticides, Toxicity, Parathion, Fish, Water pollution effects.

The potential use of small limnocorrals for pesticide toxicity studies was investigated. The experiment was carried out using eight PVC limnocorrals anchored in a fish pond. The experiment lasted 10 days, with parathion introduced on days 0 (100 mg), 3 and 6 (50 mg). The limnological conditions in the fish pond and the limnocorrals were typical of a highly eutrophic system in summer. The initial residue concentration of parathion in the treated limnocorrals averaged 25-30 ppb. Between applications, concentrations of parathion in the water rapidly declined to 40%, 11-21%, and 23%, of the initial concentration after the 1st, 2nd, and 3rd applications, respectively. In the absence of fish and no exposure to parathion the population of the cladoceran species in the limnocorrals increased 2-4 fold within 24 hours. Exposure to parathion caused elimination of the dominant cladoceran species and sharp increases in the rotifer populations, within 24 hrs. In the presence of fish the response in the two limnocorrals was not uniform. In one limnocorral the cladoceran population declined and disappeared after 5 days. In the other limnocorral the cladoceran population initially declined but recovered after 2 days and became dominant thereafter. A comparison of the zooplankton species composition and dynamics in the parathion-free limnocorrals and the fish pond revealed a pronounced containment effect. Small enclosures may be useful for evaluation of the toxic effect of chemicals in short term experiments only. (Baker-IVI)
W86-00964

SOME ASPECTS ON ALGAL TOXICITY TESTS WITH NATURAL PHYTOPLANKTON,
Jyvaeskylae Univ. (Finland). Dept. of Biology.
V. Eloranta, and L. Halttunen-Keyrilainen.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2463-2468, March, 1985. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Phytoplankton, *Phytotoxicity, *Algae, Finland, Bioassay, Seasonal variation, Physical properties, Chemical properties, Nutrients, Biomass, Species composition, Temperature effects.

A three year project was started at the beginning of 1983 in which natural phytoplankton samples were taken from surface waters monthly or bimonthly from a natural, slightly eutrophic pond in the town of Jyvaskyla, Finland. The sensitivity of the algal communities to toxic compounds was examined under various conditions. Seasonal differences were indicated in the resistance of the phytoplankton to toxic effluents. No significant correlation was detected between the toxicity response of the samples and their chlorophyll content or their photosynthetic rate. The biomass markedly affected the response of phytoplankton to toxic chemicals, as well as species composition and temperature. The response of the phytoplankton to shock-discharges should be studied only by short term tests, when the situation is most natural and less complicated concerning, for example, the effects of nutrients in the sample water. (Baker-IVI)
W86-00969

RADIONUCLIDE CONTENT MEASUREMENT AND INTERPRETATION IN FISH FROM THE UPPER RHONE RIVER IN FRANCE (MESURE ET INTERPRETATION DES TENEURS EN RADIONUCLEIDES DE POISSONS DU HAUT-RHONE FRANCAIS),
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service d'Etudes et Recherches sur l'Environnement.
L. Foulquier, B. Descamps, and Y. Baudin-Jaulent.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2470-2475, 1985. 1 Fig, 4 Tab, 9 Ref.

Descriptors: *Rhone River, *France, *Fish, *Radioisotopes, Nuclear powerplants, Radioactive wastes, Cesium radioisotopes, Cobalt radioisotopes, Zinc radioisotopes, Potassium radioisotopes, Manganese radioisotopes, Bioindicators.

The Rhone river basin includes 6 nuclear sites with a total generating capacity of 11,000 MWe. Samples taken by the Commissariat a l'Energie Atomique (CEA) were used to evaluate radiocontamination of fish by gamma emitters. The
fallout and of liquid waste discharge was
ly studied at the Bugey site (1 graphite-g
and 4 PWRs). The constant natural rad
due to K-40 was about 2200 pCi/kg
weight. Artificial radioactivity measure
from the plant was due to Cs-137s in f
(approx. 10 pCi/kg fresh weight). In
downriver, from December 1974 to Ma
only Cs-137 (approx. 30 pCI/kg), Cs-13
65 were measured. Thereafter, followi
gence of the PWRs, Co-60 was measure
40 pCi/kg, Co-58 at about 250 pCi/kg a
at about 30 pCi/kg fresh weight. These
consistent with the composition of wast
show that fish can be valid bioindicato
consumption represents only 0.04% of
mum permissible dose. (Author's abstract
W86-00970

**WATER PLANTS, AN INDICATOR
DIOACTIVE CONTAMINATION (W
FLANZEN, EIN INDIKATOR FOR R
TIVE VERUNEINIGUNGEN),**
Bayerisches Landesamt fuer Wasserv
Munich (Germany, F.R.).
H. Hubel, and H. Herrmann.
Verhandlung Internationale Vereinigung
gie, Vol. 22, No. 4, p 2481-2485, Marc
Tab.

Descriptors: *Aquatic plants, *Bioindica
dioactive wastes, *Danube River, *Gunc
*Germany (Federal Republic), Radioisot
clear powerplants, Bioaccumulation,
Cooling water.

Waterplants are good indicators of r
contamination, even when the evidence
rounding water is absent. The presentat
enrichment factors for radionuclides in w
represents a useful method of quantitativ
nation of these nuclides. On the groun
nuclide combination of the surface wate
at Gundremmingen) and the cooling wat
sition from the Gundremmingen nuclea
plant tests were undertaken, to deter
origin of these nuclides in the water pl
results indicate that both the influence fr
(formed through atomic weapon tests) an
tive products for the Gundremminge
powerplant are evident. Although the in
(1977) and the consequent lessening of th
from the Gundremmingen nuclear powe
be seen in the last three years (through
small fallout influence is still observab
garding the exceptions, the radionuclid
trations in the water plants are not correl
their physical substrates. (Author's abstra
W86-00971

**MUTAGENICITY AND ORGANIC H
DETERMINATION IN BODY FLUI
TISSUES OF RATS TREATED WITH
ING WATER AND PULP MILL BLE
EFFLUENT CONCENTRATES,**
Sentralinstitutt for Industriell Forskni
(Norway).
For primary bibliographic entry see Field
W86-00993

**CONTRIBUTION TO THE DETERMI
OF PARTICULATE ORGANIC CAR
WATER SAMPLES (EIN BEITRAG Z
TIMMUNG VON PARTIKULAREM O
CHEN KOHLENSTOFF IN WASSERP**
Akademie der Wissenschaften der DD
Zentralinstitut fuer Mikrobiologie und E
telle Therapie.
G. Proft.
Acta Hydrochimica et Hydrobiologica,
No. 6, p 631-636, 1983. 2 Tab, 13 Ref.

Descriptors: *Organic carbon, *Particulat
*Water analysis, Filtration, Oxidation,
try.

The method after Strickland and Parsons
fied for fresh water as follows: filtration
fiber paper, oxidation with K2Cr2O7

r 2 h at 130 C, dilution to 2.5 times the
/ aqua dest., centrifuging-off of the tur-
d extinction measurement at 445 nm
e blank value, the sample solution being
o the transmission of 100% (extinction
ıce, the following calibration line holds
ıcentration C and the quantity of oxida-
ɔn Ox: C=E(1cm) c . 0.162 . Ox, C in
The oxidation solution contains 4.8 g
as dissolved in 20 ml aqua dest. and
ith con. H2SO4 to 1 l. With 5 ml of this
ıe is able to determine 0.05-1 mg C/
ɔration is performed with 125 mg/l glu-
ion. Comparative investigations have
ɔod agreement with elementary-analyti-
ıed measured values. The errors have
nined mainly by sampling. In the range
ıll values one must take into account a
of the filter due to the adsorption of
ɔrganic substances on the filter. (Au-
ıct)

**)MATOGRAPHIC DETERMINA-
FREE VOLATILE FATTY ACIDS (C2
IN PERCOLATION WATER OF
LD REFUSE DUMPING PLACES
HROMATOGRAPHISCHE BESTIM-
)N FREIEN FLUCHTIGEN FETT-
C2 - C6) IM SICKERWASSER VON
LDEPONIEN),**
ponie, Potsdam (German D.R.).
nann, L. Hartung, and S. Kruger.
chimica et Hydrobiologica, Vol. 11,
7-655, 1983. 3 Fig, 3 Tab, 25 Ref.

*Wastewater analysis, *Fatty acids,
*Landfills, Domestic wastes, Silage,
latile compounds, Gas chromatogra-

ve experiments aimed at determining
ile fatty acids (C2 to C6) in organical-
luted percolation water of household
ıg places, a column packed with 10%
) M on Chromatron N-AW-DMCS
ɔeen conditioned for five days at 270
quently covered with 10% hard wax
um. At short retention times the in-
ɔmeric column pairs are completely
ually favorable results were obtained
d manure and silage extracts. The
ts lie between 10 and 20 mg/l, the
ard deviation is 20-30% in the range
letection limit and 2-3% at 200 mg/l
ange. In the investigation of percola-
ith concentrations between 235 and
ɔroducibility lies at a mean relative
ation of 0.5-2.8%. The technique is
ɔr routine checking. (Author's ab-

**N OF SIMPLE PRESERVING
S FOR WATER INVESTIGA-
ENDUNG EINFACHER KONSER-
ERFAHREN FUR WASSERUN-
GEN),**
v. (Germany, F.R.). Inst. fuer Sied-
rtschaft.
ether, and M. Doll.
imica et Hydrobiologica, Vol. 13,
1985. 7 Fig, 2 Tab, 12 Ref.

Wastewater analysis, *Effluents,
rvation, Temperature effects, Hy-
centration, Orthophosphates, Phos-
al oxygen demand, Organic carbon,
Nitrates.

from the influent and effluent of a
ewater treatment plant were imme-
l and investigated at different inter-
r weeks after sampling. They were
ark at 277 and 293 K and at pH 2
None of the measures resulted in a
tion or preservation of the samples:
cannot be stabilized by any meas-
osphate need not be stabilized; the
es which are still useful only at pH
OC and DOC do not show useful

results with any of the applied techniques; and the results are equally insufficient for ammonium and nitrate ions. In addition, differences occur in the behavior of the samples taken from the influent and effluent. In agreement with the results published in the literature, the chemical analysis has to be carried out within 6 hr after sampling. (Author's abstract)
W86-01009

ROLE OF THE DAPHNIA BIOASSAY IN THE ASSESSMENT OF THE QUALITY OF EFFLUENT DISCHARGES,
Yorkshire Water Authority (England).
G. M. Morris, and F. T. Buckley.
Water Pollution Control, Vol. 83, No. 4, p 539-546, 1984. 1 Fig, 7 Tab, 11 Ref.

Descriptors: *Water quality, *Daphnia, *Bioassay, Toxicity, Biological properties, Monitoring, Trout.

There is a need for a reliable, effective and simple biological method for determining the suitability of an effluent discharge containing highly toxic often unknown chemicals. A bioassay using Daphnia magna has recently been adopted as a BSI Standard which is the first method described for the biological testing of water quality. The Daphnia bioassay has several advantages, compared to the use of fish, especially the ease of culturing the much smaller Daphnia and the consequent savings in space and cost. From a survey of the literature and data available it appears that Daphnia magna and rainbow trout are equally susceptible to a wide range of toxicants. A successful demonstration has been outlined in the use of the Daphnia bioassay in the monitoring and control of discharges from a toxic waste landfill site. The bioassay is an acute test and the effect of sub-lethal and chronic damage cannot be assessed. Moreover, the true effect of any particular toxicant in the environment requires detailed investigation and research. Finally, several suggestions are made regarding the use of the bioassay and Daphnia in general. In particular one important use could be as a condition for inclusion in consents for the discharge of effluent into inland waters or public sewers. (Baker-IVI)
W86-01024

DETERMINATION OF SELENIUM IN SEWAGE SLUDGE USING AN ACID-DIGESTION BOMB AND FLUORIMETRY,
North West Water Authority, Warrington (England). Western Div.
I. A. Fleet, and G. S. Taylor.
Water Pollution Control, Vol. 83, No. 4, p 562-568, 1984. 3 Fig, 5 Tab, 34 Ref.

Descriptors: *Selenium, *Sludge, *Acid digestion bomb, *Fluorimetry, Spectroscopy, Acid digestion, Pollutant identification, Industrial wastewater, Domestic wastewater.

Selenium concentrations have been determined in samples of sludge taken from the major sewage-treatment works in the Liverpool and West Lancashire (England) conurbation. A number of these treat significant amounts of industrial effluent in admixture with domestic sewage and a considerable range of industrial activity is undertaken in their drainage areas. The concentrations of selenium found were not high, being broadly in agreement with data previously reported. Overall the combination of bomb digestion and fluorescence spectroscopy proved successful. In particular the bomb performed safely (over fifty digestions per bomb without mishap) and was consistently capable of almost total digestion. The bomb digestion described could prove valuable in the preparation of sludge for the estimation of other determinands and as a reference method when assurance of complete digestion is desirable. As is frequently the case when adapting analytical techniques to the determination of trace species in sewage sludges, the main obstacle was found to be the effect of the matrix. EDTA was the most suitable complexing agent but the standard additions method was necessary to cope with variations in the sludge cation matrix. The least satisfactory aspect of the procedure was the demand on the analysts' time and the development of a better system of matrix control to obviate the need for standard additions would be worthwhile. (Baker-IVI)
W86-01026

FLUX USE FOR CALIBRATING AND VALIDATING MODELS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. H. Wlosinski.
Journal of Environmental Engineering, Vol. 111, No. 3, p 272-284, June, 1985. 10 Fig, 3 Tab, 11 Ref.

Descriptors: *Water quality, *Model studies, *Calibration, *Validation, Dissolved oxygen, Simulation, DeGray Lake, Arkansas.

Predicted flux, or process rates, must be considered along with predicted state variables when calibrating or validating water quality models. Concentrating only on changes of state variables and ignoring predicted fluxes could result in the implementation of inappropriate management strategies. To illustrate this, the Corps of Engineers' one-dimensional reservoir water quality model, CE-QUAL-R1, was calibrated using data collected at DeGray Lake, Arkansas. Initial predictions of dissolved oxygen, using coefficient values obtained from the literature, were not satisfactory. Evaluation of the flux predictions for oxygen showed which processes were most important in regulating dissolved oxygen, and showed those that were incorrect when compared to measured values. During the ensuing calibration simulations, as the flux predictions were brought more in line with measured values, the predictions of dissolved oxygen improved markedly. (Author's abstract)
W86-01039

SEARCH FOR ACID-FAST BACILLI IN BOTTLED MINERAL WATERS,
Pisa Univ. (Italy). Ist. di Igiene.
G. Caroli, E. Levre, G. Armani, S. Biffi-Gentili, and G. Molinari.
Journal of Applied Bacteriology, Vol. 58, No. 5, p 461-464, May, 1985. 1 Tab, 7 Ref.

Descriptors: *Mycobacteria, *Mineral water, *Bottled water, Bacterial analysis, Italy, Public health.

Samples of bottled mineral water sold in Italy in accordance with the law on microbiological standards were examined for the presence of acid-fast bacilli. Eighty-four samples were tested, 11 with added carbon dioxide and 73 without. Acid-fast bacilli were found in 1 of the former samples and in 8 of the latter, a total of 10.7%. The mycobacterial count was always very low (2-3 cfu/l) except for one sample which showed large numbers of Mycobacterium sphagni. This finding was not confirmed in two following samplings of the same water. The other acid-fast bacilli isolated were: M. gordonae (four strains), M. flavescens (one strain), M. phlei (one strain) and Nocardia sp. (two strains) in two samples of different water. These bacilli are not thought to be normal component of the waters but are the result of incidental contamination. The risk of infection from drinking such waters can be regarded as irrelevant in hospitalized or immunologically compromised subjects who face a greater risk when using tap water for drinking or washing. (Author's abstract)
W86-01054

RAPID METHOD FOR THE ANALYSIS OF TRIHALOMETHANES IN WATER,
South Australia Engineering and Water Supply Dept., Salisbury. State Water Labs.
B. C. Nicholson, D. B. Bursill, and D. J. Couche.
Journal of Chromatography, Vol. 325, No. 1, p 221-230, May, 1985. 4 Fig, 4 Tab, 17 Ref.

Descriptors: *Trihalomethanes, *Water analysis, Gas chromatography, Electron-capture detection, Sample preservation, Halogenated hydrocarbons.

A rapid and precise method for the analysis of trihalomethanes (THMs) in water is described. Samples are extracted with methylcyclohexane and analyzed by gas chromatography using a short capillary column and electron-capture detection.

THMs elute with baseline separation in 1.25 min, and detection limits of 1 micro-g/l are readily achievable using 100-ml samples and 2 ml of solvent. Standards are prepared in the same way as samples by extraction of aqueous solutions to compensate for the relatively low extraction efficiencies which result from the low solvent to water ratio used. Ascorbic acid is a more effective sample preservative than sodium thiosulfate. (Author's abstract)
W86-01082

DETERMINATION OF TRACE AMOUNTS OF ORGANOPHOSPHORUS PESTICIDES AND RELATED COMPOUNDS IN SOILS AND SEDIMENTS USING CAPILLARY GAS CHROMATOGRAPHY AND A NITROGEN-PHOSPHORUS DETECTOR,
State Chemical Supervision Service, Soeborg (Denmark).
J. Kjolholt.
Journal of Chromatography, Vol. 325, No. 1, p 231-238, May, 1985. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Organophosphorus pesticides, *Sediment analysis, *Pollutant identification, Gas chromatography, Wastewater analysis.

A sensitive, selective and relatively precise method was developed for the determination of organophosphorus compounds in matrices with high contents of organic or biological material, and has been tested on soil and sediment samples. Homogenized samples are subjected to Soxhlet extraction with acetone-n-hexane and the extract is partitioned between methylene chloride and water. The extract of the combined methylene chloride phases is cleaned up by adsorption chromatography and analyzed by capillary gas chromatography using a nitrogen-phosphorus detector. Recoveries at the 10 ppb level are between 54.6 and 82.4% with standard deviations between 3.1 and 8.9%. Detection limits are between 95 and 220 ng/kg. With minor adjustments the method is applicable to wastewater and foodstuffs, for which the Soxhlet extraction step is not needed. The method is currently being used in a study of the dispersal of pollutants from a point source to a marine inlet. (Moore-IVI)
W86-01083

EVAPOTRANSPIRATION DERIVED FROM SATELLITE OBSERVED SURFACE TEMPERATURES,
Utrecht Rijksuniversiteit (Netherlands). Inst. voor Meteorologie en Oceanografie.
For primary bibliographic entry see Field 2D.
W86-01135

SUITABILITY OF DIFFERENT COUNTING VIALS AND LIQUID SCINTILLATORS FOR DETERMINING TRITIUM IN WATER (DIE EIGNUNG VERSCHIEDENER MESSFLASCHCHEN UND SZINTILLATORFLUSSIGKEITEN ZUR BESTIMMUNG VON TRITIUM IN WASSER),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
For primary bibliographic entry see Field 7B.
W86-01142

CYTOTOXICITY/GENOTOXICITY: THE APPLICATION OF CELL CULTURE TECHNIQUES TO THE MEASUREMENT OF MARINE SEDIMENT POLLUTION,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 5C.
W86-01158

QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIPS AND MIXTURE TOXICITY STUDIES OF ALCOHOLS AND CHLOROHYDROCARBONS: EFFECTS ON GROWTH OF DAPHNIA MAGNA,
Utrecht Rijksuniversiteit (Netherlands). Dept. of Veterinary Pharmacology, Pharmacy and Toxicology.
For primary bibliographic entry see Field 5C.
W86-01160

LEACHATE ATTENUATION IN THE UNSATURATED ZONE BENEATH LANDFILLS: INSTRUMENTATION AND MONITORING OF A SITE IN SOUTHERN ENGLAND,
Aspinwall and Co., Shrewsbury (England).
H. D. Robinson, and J. L. Lucas.
Water Science and Technology, Vol. 17, No. 4/5, p 477-492, 1985. 5 Fig, 4 Tab, 15 Ref.

Descriptors: *Groundwater pollution, *Leachates, *Landfills, *Monitoring, Water pollution sources, Attenuation blankets, Unsaturated zone, Waste disposal, Anaerobic conditions, Hydrogen ion concentration, Chlorides, Organic compounds, Temperature effects, Gases, England.

In the United Kingdom great reliance is placed upon the attenuation of contaminants which occurs as leachate seeps through intergranular unsaturated zones beneath landfill sites. At a site in Southern England, the landfill design incorporated an engineered, semipermeable attentuation blanket, using locally available calcareous sands and silt, emplaced to a minimum depth of 6 m above the water table. Installation of over 100 sampling and monitoring instruments within this unsaturated zone before waste disposal began in June 1982 made it possible to obtain water samples from the saturated and unsaturated zones, gas samples from the unsaturated zone, and to measure soil water pressure, electrical conductivity, and temperature in situ, at 3 monthly intervals since this date, to allow movement and attenuation of decomposition products of solid wastes to be monitored. The unsaturated zone rapidly became anaerobic as a result of migration of landfill gases through it, well in advance of any leachate front. The high buffering capacity of the calcareous sand/silt mixture prevented reduction in pH-values, and high concentrations of ammonia did not occur, probably as a result of cation exchange processes. Migration of other leachate constituents occurred, with raised concentrations of chloride and organic constituents detected after 15 months. The rate of migration varied significantly between individual sites. Based on the total volatile acids to chloride ratio, methane fermentation processes are active at least in some regions of the unsaturated zone, but their efficiency may suffer from the combined effects of direct toxicity of fatty acids and relatively low temperature. (Moore-IVI)
W86-01177

F SPECIFIC RNA BACTERIOPHAGES IN SEWAGE: METHODOLOGY AND OCCURRENCE,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. voor Zoonosen Lebensmittelmikrobiology.
A. H. Havelaar, W. M. Hogeboom, and R. Pot.
Water Science and Technology, Vol. 17, No. 4/5, p 645-655, 1985. 1 Fig, 7 Tab, 23 Ref.

Descriptors: *Bacteriophage, *Wastewater analysis, *Bioindicators, Viruses, Salmonella, Industrial wastewater, Hospitals, Food-processing industry, F specific bacteriophage.

F specific RNA (FRNA) bacteriophages are attractive models for the study of the fate of animal viruses in water treatment processes and pure cultures (MS2, f2) have frequently been used in model experiments. The use of indigenous FRNA phages has been hampered by the lack of selective enumeration methods. Usually, bacteriophages in sewage are enumerated by counting the number of plaques produced in a lawn of an Escherichia coli host strain. Both somatic and F specific phages will contribute to the count. A simple and highly selective method, based on a specifically constructed host strain of Salmonella typhimurium (WG 49, phage type 3 Nalr (F'42 lac :: Tn5)), was developed. Counts on this host strain normally originate exclusively from F specific phages, because there are few somatic Salmonella phages in most sewage samples. FRNA phage counts from natural sewage samples using this host strain are more reliable and higher than those obtained on E. coli hosts. F specific bacteriophages were detected in all samples investigated in numbers ranging fro 50,000 pfu/ml. Data are presented on the and types of F specific phages in mixed do industrial sewage; in poultry pro wastewater and in hospital wastewater. The tial of F specific phages as water quality ind is discussed. (Author's abstract)
W86-01189

INACTIVATION OF HEPATITIS A OTHER ENTERIC VIRUSES AND INDIC ORGANISMS IN WATER BY CHLO TION,
National Inst. for Water Research, Pretoria Africa).
W. O. K. Grabow, P. Coubrough, C. Hilner B. W. Bateman.
Water Science and Technology, Vol. 17, N p 657-664, 1985. 2 Fig, 2 Tab, 16 Ref.

Descriptors: *Viruses, *Bioindicators, *Cl tion, Bacteria, Bacteriophage, Residual c Wastewater treatment, Water treatment, B analysis, Chlorination.

Hepatitis A virus (HAV) and various in organisms were mixed together in autoclav filter effluent and broth-enriched tap wat the survival kinetics of individual organisn the addition of chlorine were compared. C was present in the reaction mixtures predom in the form of combined residuals. HAV w merated by a most probable number dilutio using PLC/PRF/5 liver cells for propaga the virus and radioimmunoassay for its de In both reaction mixtures HAV survived than Escherichia coli, Streptococcus faeca liovirus type 2, coxsackievirus B5 and r type 3, while it was less resistant than co MS2, coliphage VI (except in tap wate simian SA-11 rotavirus and Mycobacterium tum. The survival data indicate that viru cluding coliphages) tend to be relatively r sistant to combined chlorine residuals than ria, while bacteria tend to be relatively mor ant to free chlorine residuals than viruses. C bacteria may thus be fairly reliable indica the virological safety of waters disinfected chlorine residuals, but not of waters disinfe combined chlorine residuals, as in the case chlorination of wastewater or the chloran of drinking-water supplies. The relatively l sistance to combined chlorine residuals o and SA-11 virus (which is closely related to rotavirus) emphasizes the shortcomings of i available for virological water analysis they do not detect HAV and rotavirus. The support views that the virological safety chlorinated waters can be reliably monito means of practical indicator systems consi appropriate combinations of determinants the standard plate count, coliform bacter phages, acid-fast bacteria and fecal strep (Author's abstract)
W86-01190

EFFECTS OF WATER QUALITY ON M POROUS FILTER METHODS FOR EN VIRUS CONCENTRATION,
North Carolina Univ. at Chapel Hill. D Environmental Sciences and Engineering.
M. D. Sobsey, T. Cromeans, A. R. Hickey, S. Glass.
Water Science and Technology, Vol. 17, N p 665-679, 1985. 8 Tab, 9 Ref. EPA grant R

Descriptors: *Viruses, *Humic acid, *Fulv *Suspended solids, *Filters, Water quality, compounds, Particulate matter, Clay, Wate sis.

Model enteric viruses were concentrate seeded samples of raw, finished and granul vated carbon (GAC)-treated waters an GAC-treated waters supplemented with h fulvic acid or bentonite clay particles by tion to electropositive (Virosorb 1MDS) f pH 7.5 or electronegative (Filterite) filter 3.5 with and without 5 mM added MgC lowed by elution with 0.3% beef extract in

pH 9.5. Natural particulates in raw and ters had little effect on virus concentra- ncies. Soluble organic compounds re- s adsorption efficiencies from both raw d waters compared to GAC-treated the extent of interference varied with and adsorption conditions. Humic and caused appreciable reductions in polio- lsorption and recovery efficiencies with of filters. Fulvic acid caused greater n virus recovery with Virosorb 1MDS with Filterite filters. Fulvic acid inter- n virus recovery by Filterite filters was y the presence of 5 mM MgCl2. Al- ic acid reduced virus recoveries by f filters, its greatest effect was on virus recovery from Filterite filters. Benton- hanced poliovirus retention by both as much as 8-fold. However, the pres- often interfered with elution of re- es from both filter types. Under some verall virus recoveries were consider- rom water with clay than from clay- water. The results of this study sug- gh concentrations of soluble organic as humic and fulvic acids and suspend- ch as bentonite clay may interfere ith virus recovery by filter adsorption- ods. (Author's abstract)

ON OF INFORMATION ABOUT VITY IN THE COMPUTING OF ENTRATIONS, ILLUSTRATED BY URFACE WATERS SITUATED IN XONY,

niv. Braunschweig (Germany, F.R.). ltbauwesen.
M. Gorsler, J. Poltz, and D. Bock.
e and Technology, Vol. 17, No. 6/7, 5. 4 Fig, 3 Tab, 4 Ref.

*Conductivity, *Hydrogen ion con- Lower Saxony, *Germany (Federal kes, Rivers, Water pollution, Water oring, Calcium, Salinity, Mathemati-

and pH value are two of the few water which can be continuously lectrodes. The electrical conductivi- alue are continuously recorded by tions at important surface waters in y, Federal Republic of Germany. directly transmitted to the surveil- Hildesheim. Estimates of concentra- ost important ions in water were mathematical models. The basis for s are the conductivity and, in case of e, the pH value as well. The meth- strated by using data from the river m the shallow lake Dummer. The f the main rivers in Lower Saxony rized by a very high and fluctuating than 90% of the salt pollution is sh mine wastes. The salt concentra- timated between monthly sampling natical model. The lake Dummer is highly productive. In spring, cal- ations decrease from about 80-90 50-60 mg/l. Correspondingly the f the lake water varies between ro-S/cm and 400 micro-S/cm in ttempt was made to calculate the concentrations from the continuous- value and conductivity. The inves- d that it is possible to compute the f the most important solution con- face waters from conductivity and equations for calculating the ion are specific for each water system h part of it. (Moore-IVI)

, AUTOMATIC DETECTION OF SPHATES AND CARBAMATES TILIZING ENZYME MICROCA-

r Water Research, Pretoria (South

n, P. C. Kuhn, and P. P. van Niekerk.
Water Science and Technology, Vol. 17, No. 6/7, p 855-865, 1985. 6 Fig, 1 Tab, 12 Ref.

Descriptors: *Organophosphate pesticides, *Carbamate pesticides, *Enzyme microcalorimetry, Pollutant identification, Cholinesterase, Insecticides, Automation, Computers.

An enzyme calorimetric method, employing immobilized cholinesterase to detect harmful levels of organophosphorus and carbamate insecticides in water, is described. Immobilized cholinesterase activity was assessed automatically in a microcalorimeter by analyzing its catalytic efficiency in hydrolyzing a substrate solution which was passed over the enzyme at regular time intervals. A microcomputer was used to automate the procedure and for data acquisition. The inhibitory effects of three organophosphorus and two carbamate pesticides upon cholinesterase were studied in order to evaluate the efficacy of the technique. (Author's abstract)
W86-01226

BIOLOGICAL ASSESSMENT OF WATER QUALITY IN RUNNING WATER USING MACROINVERTEBRATES: A CASE STUDY FOR LIMBURG, THE NETHERLANDS,
Limburg Water Pollution Control Authority, Roermond (Netherlands). Dept. of Hydrobiology.
H. H. Tolkamp.
Water Science and Technology, Vol. 17, No. 17, p 867-878, 1985. 7 Fig, 1 Tab, 16 Ref.

Descriptors: *Invertebrates, *Bioindicators, *Water quality, *Limburg, *Netherlands, Species composition, Streams, Biotic index.

To obtain suitable biological methods for evaluating water quality several methods were applied to the macroinvertebrate composition of streams in the southern region of the province of Limburg (the Netherlands). After evaluation of the results through comparison followed by elimination of unsuitable methods (e.g. Trent Biotic Index, Indice Biotique, Indice de Qualite Biologique Globale) four methods remained promising: the Saprobic-index, the Quality-index, the BMWP-aspt and the Chandler-aspt. A further selection of methods must be carried out in combination with a typological classification of the streams concerned, including a description of the achievable range for each method. To this end more research in the field of stream typology is needed, especially for the province of Limburg with its high diversity of streams. (Author's abstract)
W86-01227

ENUMERATING INJURED COLIFORMS IN DRINKING WATER,
Montana State Univ., Bozeman. Dept. of Microbiology.
M. W. LeChevallier, and G. A. McFeters.
Journal of American Water Works Association, Vol. 77, No. 6, p 81-87, June, 1985. 3 Fig, 1 Tab, 105 Ref. EPA grant R807092.

Descriptors: *Bacterial analysis, *Bioindicators, *Coliforms, *Drinking water, Water quality control, Water analysis, Bacteria.

Injury to indicator bacteria can result from a variety of sources, including chlorine and other disinfectants, heat, freezing, sunlight, pH, transition metals, antagonistic plate count organisms, and possibly other undefined chemical and physical parameters. Many factors can influence injury, including time and temperature of exposure, strain of organism, physiological state, concentration of nutrients, neutralization technique dilutent and sample methodology. Effective alternative methods exist that are specifically designed for enumerating injured total and fecal coliforms. Operators and managers should be aware of the reality of injured coliforms. Injured indicator bacteria exist in every aquatic environment studied and may represent about half of the coliforms present. Utilities should perform parallel coliform analyses using m-Endo and m-T7 agars to assess the extent of occurrence of injured coliforms. Epidemiological investigations should be performed to further evaluate the role of stressed indicator bacteria in outbreaks of waterborne disease. (Baker-IVI)
W86-01265

APPLICATION OF ACUTE BIOASSAYS IN EVALUATING THE TREATMENT OF COAL LIQUEFACTION WASTEWATERS,
Department of Energy, Pittsburgh, PA. Pittsburgh Energy Technology Center.
For primary bibliographic entry see Field 5D.
W86-01284

TEST INSTRUCTIONS FOR MEASURING THE MICROBIAL METABOLIC ACTIVITY IN WATER SAMPLES,
Deutscher Verein des Gas- und Wasserfaches e.V., Eschborn (Germany, F.R.).
U. Obst.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 321, No. 2, p 166-168, May, 1985. 7 Ref.

Descriptors: *Water analysis, *Bacterial analysis, *Bacterial physiology, *Metabolism, *Enzymes, Enzymatic activity, Physiology, Chromophores, Catabolism, Chemical analysis.

Direct measurements of microbial metabolic degradation have previously been proven successful for testing influence of wastewater on surface water, describing the quality of water, analyzing groundwater, and biological treatment. Tests for measuring eight different enzymatic activities were developed; these enzymatic activities of the microbial metabolism in water can be measured after an addition of chromogenic substrates and their turnover. After the reaction the concentration of the chromophoric group proportional to the enzymatic activity is determined photometrically. If the molar value of the chromophore in the original substrate is known and the reaction is linear, the enzymatic turnover can be calculated in percent of conversion per liter and hour. With these biochemical methods, it is possible to determine enzyme activities concerning the catabolism of polymer substrates, di- and monomer fragments resulting from it, and finally energy-delivering metabolic activities. The enzymatic activity tests are suitable for use in a standard laboratory as a supplement to chemical and biological analyses; they do not call for extensive effort or expensive equipment. (Collier-IVI)
W86-01302

STATISTICAL EVALUATION OF AN INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETRIC METHOD FOR ROUTINE WATER QUALITY TESTING,
Geological Survey, Denver, CO.
J. R. Garbarino, B. E. Jones, G. P. Stein, W. T. Belser, and H. E. Taylor.
Applied Spectroscopy, Vol. 39, No. 3, p 535-541, May/June, 1985. 7 Fig, 10 Tab, 11 Ref.

Descriptors: *Spectroscopy, *Atomic emission spectrometry, *Atomic absorption spectrometry, *Molecular absorption spectrophotometry, *Inductively coupled plasma, *Emission spectroscopy, Metals, Trace metals, Water analysis, Chemical analysis.

In an interlaboratory test, inductively coupled plasma atomic emission spectrometry (ICP-AES) was compared with flame atomic absorption spectrometry and molecular absorption spectrophotometry for the determination of 17 major and trace elements in 100 filtered natural water samples. No unacceptable biases were detected. The analysis precision of ICP-AES was found to be equal to or better than alternative methods. Known-addition recovery experiments demonstrated that the ICP-AES determinations are accurate to between + or - 2 and + or - 10 percent; four fifths of the tests yielded average recoveries of 95-105%, with an average relative standard deviation of about 5%. (Author's abstract)
W86-01304

INVERTEBRATE BIOASSAYS WITH NORTH SEA WATER SAMPLES. I. STRUCTURAL EF-

FECTS ON EMBRYOS AND LARVAE OF SERPULIDS, OYSTERS AND SEA URCHINS,
Biologische Anstalt Helgoland (Germany, F.R.)
K. Klockner, H. Rosenthal, and J. Willfuhr.
Helgolander Meeresuntersuchungen, Vol. 39, p 1-19, 1986. 5 Fig, 1 Tab, 33 Ref.

Descriptors: *North Sea, *Bioassays, *Invertebrates, *Ocean dumping, Immature growth stages, Oysters, Sea urchins, Polychaetes, Titanium dioxide, Sludge, Water pollution effects, Waste disposal.

The initial approach and the first results of bioassay techniques testing North Sea water samples from various dump sites in the laboratory are reported. Special attention is given to detailed methodological descriptions because of the importance of various handling procedures as contributors to experimental background variability. The usefulness of larval bioassay with sea urchins, oysters and polychaetes in future control and effects monitoring studies is discussed. A titanium dioxide dumping site was sampled immediately after dumping and 10 hr after dumping. Samples were also taken in the sewage sludge deposition area in the intervals between the usual dumping activities, regardless of the exact dumping schedule. The preserved bioassay test organisms were inspected microscopically to count percentages of normal larval hatch in test water samples, reference water samples and laboratory aged control water samples. A significant suppression of larval development of Pomatoceros triqueter in the trail water of the titanium dioxide dump site was noted while the development of sea urchin larvae was still affected in the 10 hr surface samples. Hatching of all test organisms in bottom-water samples from the center of the sewage sludge dump site was affected to different degrees when compared to reference areas about 4 km north or 6 km northwest of the dumping area. Further verification is needed to minimize experimental background variability of the bioassay and to enlarge the catalogue of suitable effects criteria. (Baker-IVI)
W86-01318

5B. Sources Of Pollution

DISTRIBUTION AND DECOMPOSITION OF LIGNOSULPHONATES IN LAKE PAIJANNE, CENTRAL FINLAND,
Jyvaeskylae Univ. (Finland). Inst. for Environment Research.
K. Granberg, and J. Granberg.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2254-2258, 1985. 1 Fig, 5 Tab, 12 Ref.

Descriptors: *Lignin, *Lignosulfonates, *Lake Paijanne, *Finland, *Fate of pollutants, Pulp and paper industry, Industrial wastewater, Pollution load.

Loading and distribution of lignin compounds in Lake Paijanne, Finland, were calculated for the 1960's, 1982, and predicted for 1985. The lake has received varying amounts of lignin in wastes from pulp and paper plants on its shore. It has a highly irregular shape, so individual basins were considered separately. Decomposition of lignin was calculated based on the equation: C = C sub o x 10 to the -kt power, where C = lignin loading (tons/day) as Na-lignosulfonates after time t, C sub o = original lignin loading (tons/day), k = the decomposition coefficient, and t = time in days. Three different decomposition coefficients were used: k sub 1 = 0.00131/day for the period 1-100 days, k sub 2 = 0.0004/day for the period 100-365 days, and k sub 3 = 0.0003 for the period 365-1,000 days. A computer program was used that calculated lignin loading of each basin in tons/day and the ligonsulfonate concentration (mg/l) using lignin loading from the pulp mill (tons/day), basin volume (cu m), and mean discharge as inputs. Calculated lignin loads within the 9 basins of the lake were much higher in the 1960's (58.5 tons/day, lignosulfonates 4.2-26.8 mg/l) than in 1982 (14.2-54.1 tons/day, lignosulfonates 1.0-3.3 mg/l), but the levels predicted for 1985 are somewhat higher (17.5-65.1 tons/day, lignosulfonates 1.1-6.9 mg/l), with exact levels depending on which of three discharge assumptions is used. The higher loadings are related to the start-up of a new plant at Aanekoski contributing 62 tons/day lignin load. The results calculated here represent the steady-state situation; predicted results must therefore be confirmed by actual results obtained 2-3 yr after the prediction was made. (Rochester-IVI)
W86-00939

MODIFICATION OF THE RELATIVE IMPORTANCE OF THE CARBON BALANCE IN A POLLUTED BROOK AFTER A PERIOD OF SPATE (MODIFICATION DE L'IMPORTANCE RELATIVE DES FLUX DE CARBONE D'UN RUISSEAU POLLUE APRES UNE PERIODE DE CRUE),
Savoie Univ., Chambery (France).
D. Fontvielle, and B. Cazelles.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2270-2276, 1985. 3 Fig, 1 Tab, 17 Ref.

Descriptors: *Carbon balance, *Stream pollution, *High flow, Pollution load, Invertebrates, Biomass, DNA, Carbon dioxide, Sedimentation, Precipitation, Organic matter.

During seven months (October 1981 to April 1982), the carbon balance of an organically polluted brook was followed from the measure of several parameters: benthic and water organic load, macroinvertebrate biomass, DNA, CO2 production of the sediment and emergences. The results are interpreted in relation to the precipitation and to the stream discharge. It appears that the role played by the biological processes is negligible compared to the rate of the waste input or to the rate of the sedimentation. (Author's abstract)
W86-00940

SELF-PURIFICATION WITH CONTROLLED REDOX CONDITIONS,
Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Hydrologie.
T. Frevert, and I. Baumgartner.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2310-2313, 1985. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Oxidation-reduction potential, *Wastewater treatment, *Chemical oxygen demand, *Self-purification, Hydrogen ion concentration, Anoxic conditions, Water treatment, Dissolved oxygen.

Using a specialized apparatus and mixtures of domestic sewage and activated sludge, pe/pH feedback control was compared with no control for chemical oxygen demand (COD) removal. Redox intensity set points (pe sub 7, ie, referred to pH 7) ranged from 5.5 (full aeration) to -4.3 (no oxygen input). COD removal rates ranged from 10 to the -1.93 power per day under fully aerated conditions to 10 to the -3.12 power under completely anoxic conditions. When pe was feedback controlled so that O2 input was restricted to a certain set point, dissolved oxygen (DO) concentrations at all set points < or = 4.3 + or - 0.5 decreased immediately to zero, but corresponding COD removal rates remained in the same order of magnitude as with full aeration. Only with pe sub 7 < or = 0 (pH 7) did COD removal rates decline to 'anoxic' levels. pH was also feedback controlled. At pH = 6.0 + or - 0.2, COD removal rate was much lower corresponding to the CO2 accumulation at this pH. The economic advantage of O2 regulation becomes apparent when DO versus pe feedback control are compared. With the typical minimum DO feedback control condition of = 1 ppm, there would be a 0.07 kp per cu m per hr loss in oxygen feed. Control of the oxic self-purifying activity by pe feedback can be done at zero DO concentration, leading to maximal velocities of oxygen supply to DO-consuming microorganisms. (Rochester-IVI)
W86-00945

MERCURY IN SEDIMENT IN SWEDISH FOREST LAKES,
National Swedish Environment Protection
Solna.
K. Johansson.
Verhandlung Internationale Vereinigung L
gie, Vol. 22, No. 4, p 2359-2363, 1985. 2
Ref.

Descriptors: *Mercury, *Lake se
*Sweden, *Heavy metals, Metals, Water p
Sediments, Spatial distribution, Stratigrap
drogen ion concentration, Source of po
Organic matter, Water depth.

Mercury content of Swedish lake sedim
apparently increased, mainly during the 2
tury; in southern and central Sweden
content increases in the uppermost sedim
about 200 micro-g/kg of dry sedimen
whereas in the northernmost part of the
the increase is only about 20 micro-g/kg D
cury contents of surface sediments were st
106 lakes, and the vertical distribution of
in sediments was studied in 14 lakes. In s
from lakes in the southwestern area, near t
mercury content in sediments was correla
three factors: organic matter content (r=0
of the water (r=-0.40), and water depth
(all p < 0.01). In the central part of the
sediment mercury co-varied strongly with
matter (r=0.73, p < 0.001); when factors
ing the mercury content in the sediment
area are accounted for, no major differ
mercury levels in the sediments from th
areas are seen. Two areas in the north-cen
of the country had much lower mercury c
the mercury content of sediments decrea
north to south (r=-0.38, p < 0.05), wit
depth and pH factors being of secondary
tance. The increase in mercury in sedim
Swedish lakes during the 20th century aln
tainly has anthropogenic causes; in Swed
ably about 40,000 lakes larger than 0.01 s
affected by these elevated mercury levels
ester-IVI)
W86-00952

CADMIUM AND CHROMIUM IN WATERS, SEDIMENTS AND BIOTA O VAL PARMA RUNNING WATER E TEM,
Parma Univ. (Italy). Ist. di Ecologia.
G. Gorbi, and G. Campanini.
Verhandlung Internationale Vereinigung L
gie, Vol. 22, No. 4, p 2385-2389, 1985. 1 Fig
12 Ref.

Descriptors: *Val Parma, *Torrente Par
River, *Italy, *Cadmium, *Chromium, *Se
*Bioaccumulation, Macroinvertebrates,
Heavy metals, Metals, Water pollution
Fate of pollutants.

The bulk of Cd and Cr in the Val Parma (
Parma, tributary of the Po River, Italy)
basin was found in the sediments; water s
benthic macroinvertebrates, and algae w
pled. Stations were Lago Santo (1) and B
which receive unpolluted mountain
Cinghio (3), which collects hill and some
tural runoff, Galasso (4), which receive
from agricultural areas with some industri
ty, Naviglio Navigabile (5), which receiv
and industrial wastes, and Colorno (6),
downstream from all the others, and rece
runoff from the entire Val Parma. Levels
water were not significantly different fro
to station, but for Cr the stations could be
1, 2, 3 < 4, 5, 6. The Tukey test permitte
tion of bottom sediments based on Cd as
< 5, 6, and for Cr as 1, 2, 3 < 4, 6
macroinvertebrates, the pattern for Cd
that only Lago Santo organisms had sign
different levels, as follows: 1 > 2, 3, 4,
significant differences could be found fo
macroinvertebrates. In algae, Cd showed
tern of significant variations in content
exhibited the pattern 1, 2, 3 < 6 (no data
The results confirm that the bulk of cadm
chromium in this ecosystem occurs in t
ments. Water is strictly correlated with s
only for chromium. (Rochester-IVI)
W86-00957

**NT AS A RECORD OF COPPER POL-
IN LAKE ORTA,**
Ricerca sulle Acque, Milan (Italy). Re-
rimentale di Idrobiologia Applicata.
i, and G. F. Gaggino.
ing Internationale Vereinigung Limnolo-
22, No. 4, p 2390-2393, 1985. 3 Fig, 12

rs: *Lake sediments, *Lake Orta, *Italy,
*Fate of pollutants, Rayon industry, In-
astewater, Sediments, Chromium, Zinc,
ny, Sedimentology.

f sedimentary Cu in Lake Orta, a subal-
n northern Italy which has been receiv-
rges of a cuproammonia rayon factory
, shows that the present rate of Cu
in the sediments is 4 ton/yr, with a
on in the water at circulation of about
m. The metal content of sediments de-
he lake since 1927, excluding the natural
d of 1 ton/yr, is estimated to be 560 tons
0 tons for Cr, and 30 tons for Zn.
-3 cm) sediments contain 1-4 mg/g dry
1-2.7 mg/g Cr, and 0.3-1.5 mg/g Zn;
values were always found in the basin
rayon factory, with a general decreas-
long the longtudinal axis of the lake
outlet. Radiocesium dating of the sedi-
e it possible to show good agreement
anges in Cu content of the lake sedi-
time and the limited information avail-
ding by the rayon factory. From the
story in the sediments and other infor-
opper mobility in sediments, it is appar-
he present low pH, the lake sediments
ribute to the copper pollution, in spite
per content. Only a drastic reduction of
ammonia in the wastewater discharges
the Cu concentration to acceptable
ester-IVI)

**OF 2,4-D ON NATURAL PHYTO-
SYSTEMS IN ASSOCIATION
IOPHYLLUM SPICATUM,**
ter Research Inst., Burlington (Ontar-

bibliographic entry see Field 5C.

**LIDE CONTENT MEASUREMENT
PRETATION IN FISH FROM THE
ONE RIVER IN FRANCE (MESURE
RETATION DES TENEURS EN RA-
DES DE POISSONS DU HAUT-
NCAIS),**
d'Etudes Nucleaires de Cadarache,
-Durance (France). Service d'Etudes
s sur l'Environnement.
bibliographic entry see Field 5A.

**THALATE DEGRADATION IN
AND FRESHWATER SITES,**
Research Lab., Ocean Springs, MS.
, C. R. Cripe, P. H. Pritchard, and
in.
Vol. 13, No. 12, p 1283-1294, 1984.
5 Ref.

*Dibutylphthalate, *Biodegradation,
nvironment, Sediments, Microbial
Adaptation, Industrial chemicals,
sters.

cid ester di-n-butylphthalate (DBP)
readily biodegradable in estuarine as
ater environments. Biotic and abiotic
BP in water and sediment/water
ix different estuarine and freshwater
na, Mississippi and Florida was in-
er laboratory conditions. DBP dis-
s rapid in all microbially active sys-
antially reduced under sterile condi-
on of microbial populations to de-
s indicated in six of nine evaluations
e presence of sediment significantly
egradation rates in five of the six

sites. Even though DBP would not be considered a persistent chemical, its degradation is controlled by a variety of unknown factors which are not consistent from site to site or from one sampling date to another. Microbial communities from some sites showed adaptation, while others commenced degradation without lag. Some sites showed sediment enhance degradation and others did not, and some sites reflected rapid exponential dieaways while others showed slow linear dieaways. (Moore-IVI)
W86-00994

ASSESSMENT OF THE SIGNIFICANT PHYSICOCHEMICAL INTERACTIONS INVOLVED IN PESTICIDE DIFFUSION WITHIN A PESTICIDE-SEDIMENT-WATER SYSTEM,
Agricultural Research Service, Riverside, CA. Salinity Lab.
D. L. Corwin, and W. J. Farmer.
Chemosphere, Vol. 13, No. 12, p 1295-1317, 1984. 12 Fig, 1 Tab, 22 Ref. Water Resources Center project UCAL-WRC-W-485.

Descriptors: *Pesticides, *Diffusion, *Mathematical models, Sediment-water interfaces, Porous media, Adsorption, Hysteresis, Fate of pollutants, Physicochemical properties.

Because of the ability of soil to adsorb a variety of chemicals and the subsequent transport of the chemicals via erosion processes into aquatic systems, sediments of various water bodies have become repositories for many harmful chemicals. Using the explicit method of finite differences, a one-dimensional numerical model for the diffusion of pesticides through a sorbing porous medium under saturated conditions has been developed to assess the significant physical and chemical properties which influence the diffusion process in an aquatic system. Models were developed for the three different types of adsorption generally encountered in a sorbing porous medium: linear, Freundlich and Langmuir. An additional model deals with hysteresis for the three adsorption situations. The models show that the degree to which a pesticide is retained by a sediment is determined by the sediment's adsorptive capacity, strength of adsorption, porosity and bulkdensity, as well as the temperature of the aquatic system, the chemical nature of the pesticide and the pesticide's aqueous solution diffusion coefficient. The pollution of overlying water bodies by the diffusion of pesticides from sediments is a potential problem due to the toxic effect of very low levels of some pesticides to aquatic life forms. A sediment with a high adsorptive capacity and a high strength of adsorption would release pesticides to the water at a slower rate and in lower amounts, posing less of a potential hazard to fish. Highly organic sediments which could retain high levels of adsorbed pesticide material could pose a threat to filter-feeding organisms which rely upon organic matter at the sediment-water interface as a food source. (Moore-IVI)
W86-00995

MODULAR CONTAINERS FOR MICROCOSM AND PROCESS MODEL STUDIES ON THE FATE AND EFFECTS OF AQUATIC CONTAMINANTS,
Columbia National Fisheries Research Lab., MO.
J. N. Huckins, J. D. Petty, and M. A. Heitkamp.
Chemosphere, Vol. 13, No. 12, p 1329-1341, 1984. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Microcosms, *Fate of pollutants, *Model studies, Ecosystems, Lentic environments, Simulation, Microbial degradation, Fonofos, Trifluralin, Carbon radioisotopes, Mass balance.

Container modules are described for the laboratory simulation of selected processes and ecosystems that are representative of lentic environments. Emphasis is placed on design features permitting mass balance accountability of contaminant residues and procedural cautions required for the proper use of the described systems in environmental simulations. Experiments on the efficiency of container modules for microbial mineralization studies were conducted using C-14 labeled NaHCO3, and acidification resulted in a C-14-CO2 recovery of 97.3 +/- 4.7%. The trapping efficiency of pesticides volatilized from water and glass surfaces was investigated using the same module and the mean recoveries of C-14-fonofos and C-14-trifluralin were 114.2 +/- 3.2% and 95.2 +/- 3.5%, respectively. The mass balance capabilities of the system was also demonstrated for extended microcosm exposures to C-14-trifluralin. (Author's abstract)
W86-00996

LEACHABILITY OF CARBON-14-LABELLED 3,4-BENZOPYRENE FROM COAL ASH INTO AQUEOUS SYSTEMS,
Hoofdgroep Maatschappelijke Technologie TNO, Delft (Netherlands).
A. C. Besemer, and J. Kanij.
Chemosphere, Vol. 13, No. 12, p 1343-1351, 1984. 5 Tab, 18 Ref.

Descriptors: *Benzopyrene, *Leaching, *Coal ash, Polycyclic aromatic hydrocarbons, Carbon radioisotopes, Tracers, Hydrocarbons, Aromatic compounds, Water pollution sources.

Combustion products such as fly ash from coal-fired furnace and municipal incinerators may contain harmful substance, such as polycyclic aromatic hydrocarbons (PAH). In contact with aqueous systems, leaching of these substances can lead to contamination of the environment. The leachability of polycyclic aromatic hydrocarbons from coal ash into aqueous systems was studied. Carbon-14-labeled 3,4-benzopyrene (BaP) was deposited on coal fly ash at about 10 micro-g/g ash. The desorption of BaP was measured using aqueous solutions of acetone and methanol as extractants and liquid scintillation counting as detection method. In all cases the C-14 recovery was incomplete. Using water as extractant, C-14 recoveries of about 1% were found. In the presence of a non-ionic surface active agent the C-14 recovery was enhanced significantly. In order to assess the potential hazard of disposed fly ash with respect to the leaching of toxic substances it is necessary to develop testing methods with real representative adsorbents under realistic aqueous waste disposal conditions. (Moore-IVI)
W86-00997

FATE AND EFFECTS OF PENTACHLOROPHENOL IN HARD- AND SOFT-WATER MICROCOSMS,
Environmental Research Lab., Athens, GA.
D. L. Brockway, P. D. Smith, and F. E. Stancil.
Chemosphere, Vol. 13, No. 12, p 1363-1377, 1984. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Pentachlorophenol, *Microcosms, *Fate of pollutants, *Water pollution effects, Hardness, Nutrients, Silica, Oxygen, Chlorophenols.

Microcosms were used to investigate the influence of water hardness on the fate and effects of pentachlorophenol (PCP). The laboratory ecosystems developed similarly in both hard and soft water with only minor differences in structure and function. After exposure to PCP, system structure showed minor evidence of impact, but the results were similar in both hard and soft water. Dissolved silica was the only nutrient that responded differently in hard and soft water. It was the only nutrient significantly influenced by PCP, and may be a sensitive parameter for detecting low level effects of toxicants in certain systems. Differences between hard and soft water were detected in net oxygen production when the systems were exposed to 4 mg/l PCP. (Moore-IVI)
W86-00998

MATHEMATICAL SIMULATION OF THE CONVERSION AND TRANSPORT OF NUTRIENTS IN DRAINAGE AREAS - A REVIEW OF THE LITERATURE (MATHEMATISCHE SIMULATION VON NAHRSTOFFUMWANDLUNG UND -TRANSPORT IN EINZUGSGEBIETEN-LITERATURUBERSICHT),
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
V. Mohaupt, and G. Wernecke.
Acta Hydrochimica et Hydrobiologica, Vol. 11,

No. 6, p 609-621, 1983. 65 Ref.

Descriptors: *Mathematical models, *Simulation, *Nutrients, *Reviews, Nitrogen, Phosphorus, Solute transport, Runoff, Infiltration, Sediment erosion, Adsorption, Desorption.

Models used for mathematical description of nitrogen and phosphorus transport are outlined for various components of runoff; transport of nutrients in the process of runoff formation and concentration, infiltration and runoff within soil, surface runoff, and transport in receiving water. For surface runoff the Universal Soil Loss Equation is used frequently as the starting point for modeling, as well as for calculating sediment impulse loads. Adsorption and desorption are taken into account by their respective isotherms. Models from agriculture are used for representing soil nutrient balance, whereas for transport in receiving water, regressions on flow and deterministic models of nutrient conversion are applied. In all models the empirical share is still very high, and the model checking has often failed due to insufficient measured data. (Author's abstract)
W86-00999

ELIMINATION OF NUTRIENTS IN THE ROZKOS-RESERVOIR,
Prague Dept. of Water Technology and Environmental Engineering (Czechoslovakia).
J. Maixner, and V. Sladecek.
Acta Hydrochimica et Hydrobiologica, Vol. 11, No. 6, p 657-665, 1983. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Nutrients, *Rozkos Reservoir, *Czechoslovakia, Reservoirs, Fate of pollutants, Organic compounds, Nitrogen, Phosphorus, Iron, Bacteria.

The reservoir, having a volume of 76 cu hm, a surface area of 1001 ha and a maximum depth of 17 m, is divided by a dam into two parts. Half of the upper part with an area of 200 ha is densely covered by macrophytes (Elodea, Potamogeton). The three main tributaries with 2.6 cu m/s on an average are highly polluted and show alpha-meso-saprobic conditions. The reservoir is investigated between September and March in its longitudinal section at eight stations. The organic load and the total solids show a total decrease by 60% and 66%, respectively, and 70% of the selfpurification occurs in the upper, separated part of the reservoir. In the same way, also the total nitrogen is reduced, whereas the total phosphorus is reduced already in the upper part of the reservoir by 71%, then decreasing to 21% in the second part of the reservoir. With phosphorus, in addition to the biological elimination, precipitation by the dissolved iron also occurs; the iron concentration is reduced by 44 or 76%, respectively. The bacteriological load of water improved by two to three orders of magnitude. (Author's abstract)
W86-01002

ENVIRONMENTAL BEHAVIOR OF FLUOROTENSIDES. PART 2. INVESTIGATION ON THE BIOCHEMICAL DEGRADABILITY (ZUM UMWELTVERHALTEN VON FLUORTENSIDEN. TEIL 2. UNTERSUCHUNG DER BIOCHEMISCHEN ABBAUBARKIET),
Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Organische Chemie.
D. Prescher, U. Gross, J. Wotzka, M. Tscheu-Schluter, and W. Starke.
Acta Hydrochimica and Hydrobiologica, Vol. 13, No. 1, p 17-24, 1985. 2 Fig, 5 Tab, 7 Ref.

Descriptors: *Degradation, *Fluorotensides, *Surfactants, Tensides, Fate of pollutants, Biochemical degradation, Surfactants, Detergents.

In continuation of a publication on the behavior of fluorotensides in aqueous solution there were tested four selected fluorotensides, among them a nonionononic ethoxylated substance and three anionactive substances, in two different types of equipment with respect to their biochemical degradability. The BOD5, the potassium permanganate consumption, the dry matter contents and the loss on ignition as well as the dehydrogenase test were used as parameters for judging the degradation behavior. In all the four cases a high biochemical stability was found, so that they must be classified into the group C 'biochemically not degradable or difficult to degrade' in agreement with the results found, according to the water pollutants catalogue. (Author's abstract)
W86-01007

HUMIC ACIDS IN THE INFLOWS TO THE FLAJE RESERVOIR AFTER DEFORESTATION OF ITS WATERSHED,
Vyzkumny Ustav Vodohspodarsky, Prague (Czechoslovakia).
For primary bibliographic entry see Field 6G.
W86-01010

CONTRIBUTION TO THE ANALYTICAL DESCRIPTION OF TRANSPORT PROCESSES IN THE AQUIFER AT A DIFFUSE SUBSTANCE INPUT (BEITRAG ZUR ANALYTISCHEN BESCHREIBUNG VON TRANSPORTPROZESSEN IM GRUNDWASSERLEITER BEI DIFFUSEM STOFFEINTRAG),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
M. Schwan.
Acta Hydrochimica et Hydrobiologica, Vol. 13, No. 1, p 59-66, 1985. 1 Fig, 8 Ref.

Descriptors: *Mathematical models, *Aquifers, *Water quality, Differential equations, Solute transport, Model studies, Free water, Groundwater movement, Dispersion, Path of pollutants.

A model is described for the relation between water quantity and water quality in the aquifer with the diffuse substance input by the gravitation water being taken into account. The model is based on a partial differential equation of the second order for a flow pipe. For constant transport parameters, a sink of the kinetics of the first order and a time-dependent source term an exact analytical solution is presented and explained by a model. At a diffuse substance input, the dispersion has only a slight influence on the transport of substances contained in water. Potential applications of these solutions to different problems are mentioned. (Author's abstract)
W86-01012

GROUNDWATER POLLUTION HAZARD IN THE CAPE FLATS,
National Inst. for Water Research, Bellville (South Africa). Cape Regional Lab.
For primary bibliographic entry see Field 5G.
W86-01017

ESTIMATION OF THE LOADS OF SOME LIST I AND II SUBSTANCES TO UNITED KINGDOM TIDAL WATERS - A COMPARISON WITH PREVIOUS ESTIMATES,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 5G.
W86-01025

ESTIMATED STORE OF SOLUBLE SALTS IN THE LAKE EYRE CATCHMENT IN QUEENSLAND AND THEIR POSSIBLE TRANSPORT IN STREAMFLOW TO THE LAKE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 2A.
W86-01031

MOVEMENT OF SEPTIC TANK EFFLUENT THROUGH SANDY SOILS NEAR PERTH. I. MOVEMENT OF NITROGEN,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Animal Production.
B. R. Whelan, and N. J. Barrow.
Australian Journal of Soil Research, Vol. 22, No. 3, p 283-292, 1984. 6 Fig, 4 Tab, 23 Ref.

Descriptors: *Septic tanks, *Effluents, *Nitrogen, Path of pollutants, Ammonium, Nitrates, Hydrogen ion concentration, Wastewater treatment, wells, Leach drains, Groundwater pollution, Australia.

The movement and transformation of ni under seven septic tank installations was st Samples of the effluent and of the soil se beneath the discharge systems were taken an lyzed for ammonium, nitrate and pH. Most nitrogen came from household toilets, and passage through a septic tank, the nitroge mostly in the ammonium form. It remained form while it was in the ponded effluent abo slime layer in the absorption systems. Once passed through the slime layer into the uns ed, aerobic soil below, it was usually oxidiz nitrate within 0.5 m. This was accompanied drop in pH of about two units. However, case in which the distance between the top slime layer and the water table was less than ammonium was not oxidized to nitrate. Th taken to indicate that the saturated zone exte below the absorption system overlapped the lary fringe and consequently the soil was a bic. Accumulation of organic nitrogen was re ed to the 0.5 m slime layer which accumula the sandy base of the soak wells and leach The low cation exchange capacity of the so the high rate of conversion of ammonium effluent to nitrate in the unsaturated soil resu almost all of the nitrogen from the septic entering the groundwater except that lost to uptake. (Author's abstract)
W86-01034

MOVEMENT OF SEPTIC TANK EFFL THROUGH SANDY SOILS NEAR PERT MOVEMENT OF PHOSPHORUS,
Commonwealth Scientific and Industrial Re Organization, Wembley (Australia). Di Animal Production.
B. R. Whelan, and N. J. Barrow.
Australian Journal of Soil Research, Vol. 2 3, p 293-302, 1984. 6 Fig, 3 Tab, 17 Ref.

Descriptors: *Septic tanks, *Effluent, *Ph rus, Path of pollutants, Wastewater trea Groundwater pollution, Soak wells, Leach Sorption, Soils, Domestic wastes, Perth, Au

The potential of seven septic tank installati the Perth (Western Australia) metropolitan contribute phosphate to the groundwater v vestigated. The phosphate concentration in t solution below the soak wells and leach drai measured using immiscible displacement an pared with the phosphate concentration water flowing into the systems. The pho sorbing properties of the subsoils were mea and these were found to vary up to 100-fold the same profile. A very strong correlatio established between a laboratory measure ability of the soil to sorb phosphate and the phate sorbed in the soil profile below leach and soak wells. The correlation held only fo systems for which little further phosphat removed by reaction with the soil, and the phate in the soil solution was at or near the concentration as the phosphate in the effluen a system receiving water from the bathroom dry and kitchen the phosphate concentratio as low as 8 micro-g P/mol. For a system rec water from a toilet only, the concentration high as 29 micro-g P/ml. In systems rec water from both sources the values were in diate. For systems that had been installed fo than a few years, the concentration of phos in the soil water down to 6 m below the soa and leach drain was similar to that in the e being discharged into the soil. (Author's ab
W86-01035

STREAM DISSOLVED OXYGEN ANA AND CONTROL,
Rice Univ., Houston, TX. Dept. of Environ Science and Engineering.
D. A. Todd, and P. B. Bedient.
Journal of Environmental Engineering, Vo No. 3, p 336-352, June, 1985. 11 fig, 1 Tab,

Descriptors: *Dissolved oxygen, *Water po sources, *Water quality control, *Buffalo

astewater pollution, Water pollution
astewater treatment, Low flow, Tem-
ects, Streams, Computer models, Aer-
augmentation.

Bayou study segment is 22.5 mi in
drains 270 sq mi of western Houston,
ving the effluent from 43 waste treat-
The stream is heavily stressed by
aste loads and has shown significant
in water quality since 1970. Current
that the stream reaches critical water
for significant lengths of the stream
periods during the low flow/high
months of June, July, and August.
of critical stream dissolved oxygen
ements suggests that the high head-
levels, and many upstream package
least partly responsible for the water
ems. A computer model was calibrat-
and applied to simulate worst case
d to test a series of stream protection
A combined program of sewage plant
n, stream aeration, and flow augmen-
ound to be the most cost-effective
tutional changes will be necessary to
chnical improvements to be made.
ch of the Bayou must be designated
ality limited stream segment. This
stream standards to be set and en-
ans of a waste load allocation. Re-
and stream aeration would require
ng and legal status. Flow augmenta-
pend on receiving redesignation of
nd Barker Flood control reservoirs
storage for water quality applica-
VI)

OM USING CONSERVATION OF CONCEPT IN PLUME COMPU-

alysis, Inc., Huntsville, AL.

raulic Engineering, Vol. 111, No. 6,
une, 1985. 1 Fig, 2 Tab, 8 Ref.

lumes, *Path of pollutants, *Buoy-
ater, Thermal pollution, Jets.

f conservation of buoyancy was
he analysis of buoyant gas plumes
re. This conservation principle is
roximate form of the conservation
ion, but for gases at atmospheric
te sufficient. For buoyant thermal
in water, the use of the conserva-
cy principle should be avoided
le, especially for cases involving
eratures. Any plumes predicted by
such an approach will tend to
effect of buoyancy and this tend-
aken into account in applying the
h models. Of more fundamental
e fact that the conservation of
a basic conservation principle
nservation of mass, momentum,
ead, it is an approximation which
with caution, especially in fluids
ermal coefficients of volumetric
-IVI)

ISPERSION FROM A STEADY ONAL HORIZONTAL

, Christchurch (New Zealand).
gineering.
McNulty, and I. R. Wood.
Mechanics, Vol. 149, p 147-159,
Fig, 2 Tab, 10 Ref.

persion, *Turbulence, *Path of
natical equations, Fluid mechan-
sivity.

nal steady-state turbulent-diffu-
lved by a separation-of-variables
to a Sturm-Liouville eigenvalue
ral solution, for arbitrary veloci-
distributions, is shown to be in the form of an eigenfunction expansion. For a steady uniform flow in a wide, open channel the velocity distribution in the vertical is well approximated by a logarithmic lay and the diffusivity distribution is approximately parabolic. For these distributions the power-series solution technique for ordinary differential equations is used to determine the eigenfunctions and eigenvalues. The solution is compared with the standard solution that Holley, Siemans and Abraham (1972, J. Hydraul. Res. 10, 27-57) obtained for a uniform velocity and diffusivity distribution. Experimental results are presented, and these show that (1) the use of the correct velocity and diffusivity distribution results in a significant improvement in the agreement between experiment and theory; and (2) close to the source the fluctuations of concentration are of the order of the mean values. (Author's abstract)
W86-01055

WHEN AND WHERE TO PUT A DISCHARGE IN AN OSCILLATORY FLOW,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
R. Smith.
Journal of Fluid Mechanics, Vol. 153, p 479-499, April, 1985. 7 Fig, 13 Ref, 1 Append.

Descriptors: *Path of pollutants, *Oscillatory flow, *Mathematical equations, Flow, Discharge, Mathematical models, Dispersion, Estuaries.

Exact results are obtained for the centroid and longitudinal variance of a passive contaminant distribution at large times after an instantaneous discharge in an oscillatory flow in a straight channel of constant cross section. The precise timing and cross stream position of the discharge have a substantial and persistent influence. When and where to put a discharge in an oscillatory flow so that the spread of contaminant at large times is maximized (and the concentration is minimized) is considered. In an oscillatory flow the optimal location for a discharge will be away from the center or the sides. When the flow is oscillatory the contaminant is swept back and forth along the channel, so any time advantage is annulled. An important practical point is that real discharges are not passive. Near field momentum and buoyancy effects tend to augment the transverse mixing. The actual contaminant cloud well be wider than a passive cloud, and the effective time of discharge is earlier than the actual discharge time. The general principles are illustrated using a simple mathematical model of contaminant dispersion in a vertically well-mixed estuary of parabolic cross-section. (Baker-IVI)
W86-01056

RATE OF PRECIPITATION OF FERROUS IRON AND FORMATION OF MIXED IRON-CALCIUM CARBONATES BY NATURALLY OCCURRING CARBONATE MATERIALS,
Western Australian Inst. of Tech., South Bentley. School of Applied Chemistry.
J. E. Wajon, G.-E. Ho, and P. J. Murphy.
Water Research, Vol. 19, No. 7, p 831-837, 1985. 3 Fig, 4 Tab, 22 Ref.

Descriptors: *Fate of pollutants, *Iron, *Carbonates, *Chemical precipitation, Limestone, Calcite, Aragonite, Siderite, Supersaturation, Industrial wastewater, Wastewater pollution, Land disposal, Groundwater pollution.

An acidic iron-rich effluent produced by an industry in the southwest of Western Australia is disposed of by seepage through carbonate-rich sand dunes. The soluble iron content of the effluent was reduced from 6 g/l to less than 60 mg/l within several hundred meters of the disposal area. In order to determine what occurs under these conditions, an iron sulfate containing wastewater was reacted with aragonite, calcite and a variety of limestones and limesands pH values near 6 in an atmosphere of carbon dioxide. Siderite (ferrous carbonate) and a calcium siderite containing 10 mol% calcium were the only iron-containing products detected by X-ray diffraction, and accounted for substantially all the iron removed from solution. Calcium siderite was the major product and constituted between 50 and 100% of the iron containing product. The rate of precipitation of iron was proportional to the square of the supersaturation of the solution with respect to siderite, and increased with increase in pH and alkalinity. Precipitation occurred at different rates with different carbonate materials, tending to increase with increasing proportion of aragonite in the material. Precipitation did not occur in suspensions of calcite and was slow even in suspensions of aragonite where equilibrium was not reached within 40 days. The frequent occurrence of groundwaters apparently supersaturated with respect to siderite may be due either to slow precipitation of siderite, or to equilibrium of the groundwater with respect to a more soluble calcium siderite. The minerals present in an aquifer should be identified before conclusions on the saturation state of a groundwater with respect to siderite are made. (Moore-IVI)
W86-01058

VALIDITY OF THE LOCAL EQUILIBRIUM ASSUMPTION FOR MODELING SORBING SOLUTE TRANSPORT THROUGH HOMOGENEOUS SOILS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
A. J. Valocchi.
Water Resources Research, Vol. 21, No. 6, p 808-820, June, 1985. 6 Fig, 2 Tab, 54 Ref, 2 Append.
NSF grant CEE-8204434.

Descriptors: *Fate of pollutants, *Model studies, *Solute transport, Sorption, Soils, Mathematical models, Porous media, Chemical equilibrium.

Sorption processes that occur during reactive solute movement through porous media can be modeled using either an equilibrium or kinetic approach. Because of the resulting conceptual and mathematical simplification, many transport models assume local chemical equilibrium is valid for describing sorption reactions. This paper presents quantitative criteria to assess the validity of the local equilibium assumption for one-dimensional, steady flow through homogeneous soils. A method is described whereby formulas for solute breakthrough curve time moments can be determined without knowledge of the analytical solution to the mass transport model. This method is applied to several commonly used nonequilibrium formulations as well as the standard linear equilibrium model. The formulations considered include both the physical nonequilibrium models where the sorption rate is controlled by diffusive solute transfer between mobile and stagnant fluid zones and the chemical nonequilibrium models where the overall sorption rate is governed by the rate of reaction at the soil-solution interfaces. Criteria for local equilibrium to be valid are derived by comparing the time moment formulas for the nonequilibrium and equilibrium models. These criteria explicitly show that basic system parameters (e.g., seepage velocity, dispersion coefficient, distribution coefficient, sorption rate, boundary conditions) have a significant influence on the attainment of local equilibrium. (Author's abstract)
W86-01072

GROUND-WATER CONTAMINATION IN SILICON VALLEY,
California Regional Water Quality Control Board, Oakland. San Francisco Bay Region.
A. Olivieri, D. Eisenberg, M. Kurtovich, and L. Pettegrew.
Journal of Water Resources Planning and Management, Vol. 111, No. 3, p 346-358, July, 1985. 7 Fig, 2 Tab, 6 Ref.

Descriptors: *San Francisco Bay Area, *California, *Groundwater pollution, Water pollution sources, Soil contamination, Solvents, Underground tanks, Corrosive substances, Fuel, Wastewater, Regulations.

In the southern San Francisco Bay Area (California), a state regulatory agency carried out a questionnaire survey to determine the locations and characteristics of underground chemical storage and handling facilities at industrial sites in the area. Sampling of soil and ground water were required at sites where underground tanks containing sol-

vents were reported. The survey identified 1,692 tanks at 388 sites. The largest fraction were pretreatment sumps for industrial wastewater, followed by fuel tanks, solvent tanks, and tanks containing corrosives. Solvent tanks were reported at 96 sites. Subsurface investigations resulted in discovery of soil or ground water contamination (or both) at 75 of the 96 sites with solvent tanks. Further investigations and remedial actions are underway at these sites, and new regulations have been adopted at the state and local levels to prevent future release of industrial chemicals into soil and ground water. (Author's abstract)
W86-01108

ARSENIC, BARIUM, GERMANIUM, TIN, DIMETHYLSULFIDE AND NUTRIENT BIOGEOCHEMISTRY IN CHARLOTTE HARBOR, FLORIDA, A PHOSPHORUS-ENRICHED ESTUARY,
Florida State Univ., Tallahassee. Dept. of Oceanography.
P. N. Froelich, L. W. Kaul, J. T. Byrd, M. O. Andreae, and K. K. Roe.
Estuarine, Coastal and Shelf Science, Vol. 20, No. 3, p 239-264, March, 1985. 6 Fig, 5 Tab, 75 Ref.

Descriptors: *Arsenic, *Barium, *Germanium, *Tin, *Dimethylsulfide, *Nutrients, *Biogeochemistry, *Charlotte Harbor, *Florida, Peace River, Estuaries, Salinity, Phosphates, Nitrates, Silica, Water pollution sources, Eutrophication, Diatoms, Fate of pollutants.

Concentrations of dissolved nutrients (NO3, PO4, Si), germanium species, arsenic species, tin, barium, dimethylsulfide and related parameters were measured along the salinity gradient in Charlotte Harbor (Florida). Phosphate enrichment from the phosphate industry on the Peace River promotes a productive diatom bloom near the river mouth where NO3 and Si are completely consumed. Inorganic germanium is completely depleted in this bloom by uptake into biogenic opal. The Ge/Si ratio taken up by by diatoms is about 0.0000007, the same as that provided by the river flux, confirming that silceous organisms incorporate germanium as an accidental trace replacement for silica. Monomethylgermanium and dimethylgermanium concentrations are undetectable in the Peace River, and increase linearly with increasing salinity to the seawater end of the bay, suggesting that these organogermanium species behave conservatively in estuaries, and are neither produced nor consumed during estuarine biogenic opal formation or dissolution. Inorganic arsenic displays slight removal in the bloom. Monomethylarsenic is produced both in the bloom and in mid-estuary, while dimethylarsenic is conservative in the bloom but produced in mid-estuary. The total production of methylarsenicals within the bay approximately balances the removal of inorganic arsenic, suggesting that most biological arsenic uptake in the estuary is biomethylated and released to the water column. Dimethylsulfide (DMS) increases with increasing salinity in the estuary and shows evidence of removal, probably both by degassing and be microbial consumption. An input of DMS is observed in the central estuary. The behavior of total dissolvable tin shows no biological activity in the bloom or in mid-estuary, but does display a low-salinity input signal that parellels dissolved organic material, perhaps suggesting an association between tin and dissolved organic matter. Barium displays dramatic input behavior at mid-salinities, probably due to slow release from clays deposited in the harbor after catastrophic phosphate slime spills into the Peace River. (Author's abstract)
W86-01113

SEA-SURFACE MICROLAYER METALS ENRICHMENTS IN AN URBAN AND RURAL BAY,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. T. Hardy, C. W. Apts, E. A. Crecelius, and N. S. Bloom.
Estuarine, Coastal and Shelf Science, Vol. 20, No. 3, p 299-312, March, 1985. 7 Fig, 1 Tab, 48 Ref.
DOE DE-AC06-76RLO 1830.

Descriptors: *Microlayers, *Metals, *Water pollution sources, *Bays, Urban areas, Lead, Zinc, Copper, Cadmium, Iron, Atmospheric deposition, Coastal waters, Marine environment.

The sea-surface microlayer is an important interface between the atmosphere and ocean and a collection point for many anthropogenic materials including potentially toxic metals. A glass plate sampler sampler was developed to collect the upper 30 to 55 micrometers of the sea surface. Samples of the microlayer and subsurface bulk water from an urban and rural bay were analyzed for concentrations of Pb, Zn, Cu, Cd, and Fe. Metal concentrations in both the microlayer and bulk water were generally 2 to 15 times greater in the urban than in the rural bay. Concentrations of metals in the microlayer of both bays averaged 6 to 65 times greater than those in the bulk water. In the urban bay, microlayer concentrations of Pb, Zn and Cu from 10 to > 100 micro-g/l were common. Measured microlayer metals concentrations agree well with those predicted from atmospheric deposition rates using a previously derived empirical model developed from laboratory microcosm studies. Further work will be required to determine whether or not these high microlayer metal concentrations contain significant biologically available fractions which could impact fisheries recruitment of larval icthyoneuston. (Author's abstract)
W86-01114

FLUXES AND RESIDENCE TIMES OF HYDROCARBONS IN THE COASTAL MEDITERRANEAN: HOW IMPORTANT ARE THE BIOTA,
International Lab. of Marine Radioactivity, Monaco-Ville (Monaco).
K. A. Burns, J.-P. Villeneuve, and S. W. Fowler.
Estuarine, Coastal and Shelf Science, Vol. 20, No. 3, p 313-330, March, 1985. 3 Fig, 6 Tab, 46 Ref.
NSF grant OCE 7923321.

Descriptors: *Hydrocarbons, *Fate of pollutants, *Mediterranean Sea, *Biota, Particulate matter, Chlorinated hydrocarbons, Petroleum products, Zooplankton, Primary productivity, Microlayers, Solute transport, Sediments, Marine environment.

Settling particles collected in semi-permanent particle interceptor traps (PITs) moored at 100 m depth in a water column of 250 m at a distance of 2 km from the Monaco coast in the north western Mediterranean were analyzed for petroleum and chlorinated hydrocarbons. Time series observations of material collected between 1979 and 1982 showed that vertical mass and organic contaminant fluxes varied seasonally by an order of magnitude and corresponded with general cycles of zooplankton biomass and primary productivity in surface waters. Analyses of surface seawater including surface microlayer, dissolved and particulate phases are reported along with data from zooplankton, fecal material, and sediments collected near the trap station. Settling particles displayed two predominant patterns of petroleum hydrocarbons similar to the patterns of both 'dissolved' and 'particulate' hydrocarbons seen in surface seawater. Residence times of hydrocarbons in surface waters were computed according to recent partitioning models and compared with those calculated from the fluxes of actually settling particles and from sediment data. PCB fluxes calculated from sediment and settling particles averaged 2 to 4 ng/sq cm/yr with good agreement between data bases. Petroleum fluxes on settling particles averaged 8 micro-g/sq cm/yr but fluxes based on sediment concentrations showed that 90% of the petroleum hydrocarbons transported to depth were degraded before incorporation into compacted sediments. By evaluating fluxes and residence times with three independent data bases it is concluded that the biota are effective in transporting both particulate and dissolved organic contaminants to ocean sediments. Furthermore, the residence times of these materials in surface waters do not vary as much as would be predicted on the basis of their widely differing solubilities. (Author's abstract)
W86-01115

MODELLING KEPONE IN THE S BASS FOOD CHAIN OF THE JAMES ESTUARY,
Manhattan Coll., Bronx, NY. Environmen neering and Science Program.
J. P. Connolly, and R. Tonelli.
Estuarine, Coastal and Shelf Science, Vol 3, p 349-366, March, 1985. 8 Fig, 3 Tab

Descriptors: *Kepone, *Mathematical *Bass, *Food chain, *James River Estua cides, Path of pollutants, Perch, Croaker, contamination, Bioaccumulation.

A mathematical model that computes the lation of Kepone in the striped bass food the James River estuary was developed. pose of the model was to help under relationship of Kepone levels in impo species to sediment and water column concentrations and then to address the q why these levels still exceed Food and D ministration limits eight years after ceased. The model considers exposure thr and respiration at rates based on species b tics. It was successfully calibrated to th concentrations observed in the peri through 1982 in striped bass, white pe Atlantic croaker. The model indicates th upper levels of the food chain, diet is t route of contamination, accounting for 8 the observed concentration in croaker a perch and 91% of the observed concen striped bass. The two Kepone sources; and water column, contribute approximat ly to the croaker and white perch. T column is more significant for striped b the original source for approximately 60 observed body burdens. It was estimat criterion requiring Kepone concentratio to be at or below 0.3 micro-g/g woul dissolved water column and sediment Ke centrations to be reduced to somewhere b and 9 ng/l and 13-39 ng/g, respectively, on the species. Striped bass require th reductions in dissolved water column and Kepone concentrations to somewhere b and 5 ng/l and 13 and 24 ng/g, res (Author's abstract)
W86-01116

ARSENIC INCORPORATION IN MARSH ECOSYSTEM,
Academy of Natural Sciences of Phi Benedict, MD. Benedict Estuarine Rese
J. G. Sanders, and R. W. Osman.
Estuarine, Coastal and Shelf Science, Vo 4, p 387-392, April, 1985. 1 Fig, 2 Tab

Descriptors: *Arsenic, *Cedar Creek, * Bay, *Salt marshes, *Metals, *Fate of Arsenate, Spartina, Estuarine environm sorption, Bioaccumulation.

There are few studies of arsenic distribut various components of salt marsh ecosy even fewer studies of the impact of el senic concentrations on arsenic inco within the various ecosystem componen cate portions of Cedar Creek, a Delawar marsh, were enclosed in cylindrical m and exposed to elevated levels of inorgan (arsenate). Eight open-end fiberglass were forced into the marsh sediments to 10 cm at the water's edge, 60 cm be water. Arsenate solution was added semi to every other cylinder for nine days so centrations within the treated cylinders approximately 50 micro-g/l. All biotic a components in dosed cylinders rapidly in ed arsenic. Spartina blades showed th arsenic enrichment, with dosed plants in ing arsenic concentrations an order of higher than controls. Spartina detritus ments also exhibited greatly elevated ar centrations. Virtually all of the arsenic porated into plant tissue or strongly sorb surfaces. High enrichment factors can dead and living grass material. Increases cally available arsenic occur in the gras tus, and sediment components of the e Eighty-one percent of the arsenic was bi

The enrichment factors measured (2-13) arge considering the short duration of nent, and may be extremely important. senic concentrations in estuarine waters ected in living and non-living compo- salt marsh ecosystem, implying that rsenic will be available to organisms arsh ecosystem. (Collier-IVI)

OF DISSOLVED ORGANIC MATTER QUEOUS PARTITIONING OF PO- R AROMATIC HYDROCARBONS, niv., Halifax (Nova Scotia). Dept. of ny.
se.
oastal and Shelf Science, Vol. 20, No. 1985. 4 Tab, 39 Ref.

*Dissolved organic matter, *Organic nuclear aromatic hydrocarbons, *Hy- *Fate of pollutants, Chemical reac- threne, Anthracene, Benzanthracene, ne.

ing of six polynuclear aromatic hy- PAH) into aqueous solutions contain- organic matter (DOM) from various onments was investigated by liquid hy. Samples were obtained from the the Scotia Shelf, the Bedford Basin, Saltmarsh, and Lake Robinson Brook of terrestrial runoff were also ob- e laboratory, samples were filtered cleaned all glass filtering apparatus busted glass fiber filter. DOM was defined as that which passes through F/C glass fiber filter. Specific hydro- c matter interactions were observed. ate that the PAH investigated do not icant interaction with oceanic DOM entrations. The greatest interactions the very low solubility hydrocar- organic matter of terrestrial origin. experiments suggested that it was high (greater than approximately weight organic matter that was h the hydrocarbons. Phenanthrene are not affected by DOM from a ine environment at natural concen- enanthrene probably does not un- able interaction with terrestrially Anthracene does significantly inter- rial DOM. 1,2-Benzanthracene and show a significant interaction with OM. PAH as a class of compounds cluded to interact with naturally . The interactions are specific with mpound involved and the environ- ch the DOM is obtained. (Collier-

WIND, PHYTOPLANKTON AND CONTINUITIES UPON AMMO- TIONS IN LIVERPOOL BAY, of North Wales, Menai Bridge. Labs.
iographic entry see Field 2L.

ANCES IN THE TELTOW- SPECIAL REGARD TO HEAT ROM LICHTERFELDE POWER IN, WEST) (SAUERSTOFFBI- ELTOWKANAL - INSBESON- DEM EINFLUSS DER ABWAR- G AUS DEM KRAFTWERK E (BERLIN, WEST)),
samt, Berlin (Germany, F.R.). Boden- und Lufthygiene.
Schumann.
asser und Abwasser Forschung, 130-140, June, 1985. 10 Fig, 4

ygen balance, *Teltow Canal, wer Plant, *Berlin, *Germany), Thermal pollution, Water pol- e of pollutants, Chemical reac-

The Teltow Canal in Berlin (West) has received the effluents of 4 sewage treatment plants, the storm water runoff from about 110 sq km of urban area and the heat discharge from three big power plants. A long term measuring program served data on water quality of the canal. The continuously registered O2-concentrations and temperatures were utilized for the calculation of a temperature coefficient for oxygen consumption. Comparing differently heated parts of the canal throughout the year, we found extremely high coefficients with a mean value of 1.34/C for 1982. Rapid changes in temperature during winter and spring (up to 10 C) resulted in the highest coefficients, which could be interpreted as the activation of additional O2-consuming processes (e.g, nitrification in winter). Measures for a more efficient sewage treatment and for the restoration of the oxygen budget are discussed. (Author's abstract)
W86-01141

DIFFUSION COEFFICIENT EVALUATED FROM THE DISTRIBUTION OF NONCONSERVATIVE MATERIAL (IN JAPANESE),
Kagoshima Univ. (Japan). Faculty of Fisheries.
H. Ichikawa, and M. Chaen.
Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 33, No. 1, p 1-11, December, 1984. 5 Fig, 7 Ref.

Descriptors: *Diffusion coefficients, *Nonconservative material, *Fish farming, *Ushine, *Kagoshima Bay, *Japan, Path of pollutants, Fate of pollutants, Aquaculture, Model studies.

The horizontal eddy diffusion coefficient (DC) is estimated from the distribution of nonconservative material (NM) near a fish-cultivation area taking into account the material discharge, reduction, descending speed of material, and advection by horizontal and vertical water motion. The differential equation about DC is formulated and solved under the following conditions. 1) Consider in the vertical two-dimensional plane of which length is 'L' and the depth 'H'. 2) The distribution of NM is steady and uniform in the longshore direction. 3) The reduction rate, gamma, and the descending speed, W, are uniformly constant. 4) The production, q, has a constant value only in a limited region below the fish cages. The value of q corresponds only to the total NM discharge, T, into the sea by fish cultivation. 5) At z = H, the material dispersion due to vertical diffusion is much smaller than those due to descending and vertical advection. 6) The concentration of NM vertically averaged from z = 0 to H, c, can be represented by c(x) = (C sub o) exp (-alpha squared X x squared). 7) The ratio beta of (C) sub H to c is constant, where (C) sub H is the NM concentration at z = H. 8) The x and z components of mean current velocity, u and (w) sub H can be represented as follows, respectively: u(x) = ((u sub o) X x/L), (w) sub H = ((-u sub o) X H/L). The solution is applied to Ushine area, in the inner part of Kagoshima Bay. The distribution of COD concentration observed in summer of 1977 is used in the estimation of DC. By adopting the parameters to be as follows, H = 20 m, L = 3 km, alpha = 0.000003/cm, C sub o = 5.8 x 10 to the minus 7th power g/cu cm, beta = 0.8, T = 3 ton/day, gamma = 0.01/day, W = 0.3 m/day, and u sub o = 0.5 cm/sec, the value of DC at x = L is calculated to be 161,000 sq cm/sec, of which order of magnitude agrees with that evaluated from the data obtained by the direct measurement of current velocity for a month in summer of 1979 at the 10 m layer of the Ushine area. The total discharge or production, descending speed of material, reduction rate and water motion have the same order of magnitudes of contributions to the evaluated diffusion coefficient. (Author's abstract)
W86-01143

ECOLOGICAL SURVEY OF SEDIMENT FLUX IN COASTAL FISH FARMS - I DECOMPOSITION FEATURES OF THE FLUX (IN JAPANESE),
Kagoshima Univ. (Japan). Faculty of Fisheries.
S. Kadowaki, Y. Inazuka, and H. Hirata.
Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 33, No. 1, p 43-49, December, 1984. 4 Fig, 2 Tab, 14 Ref.

Descriptors: *Sediment flux, *Fish farms, *Aquaculture, Decomposition, Nutrients, Organic carbon, Nitrogen, Phosphates.

In order to know the decomposition mechanisms of sedimented matter in a coastal fish farm, chemical features of the sediments were observed in comparison with non-fish farm areas. The observations were conducted in December 1980 and August 1981 in the vicinity of the Fisheries Research Laboratory, Kagoshima University. Two-liter-traps were submerged at 1 m, 5 m and 10 m from the sea bottom. The periods of suspension were set to be 1 day, 2 days, 4 days, 7 days and 10 days. Organic carbon, organic nitrogen and total phosphate were analyzed in each observation. Typical examples of the sediment decomposition were observed in 1-day-suspensions of the traps. In August, average organic carbon in fish farm and non-fish farm samples were 15.6 and 5.6 g/sq m/day, respectively. Organic nitrogen concentrations in August were 1.7 g/sq m/day in fish farm and 0.7 g/sq m/day in non-fish farm. Total phosphate, 1.9 g/sq m/day, in fish farm was nineteen times higher that that in non-fish farm. The results obtained in December showed almost the same trends as mentioned above. The decomposition coefficient of organic flux in deep layer, however, was 30-70% higher than that in case of August. (Author's abstract)
W86-01145

SEASONAL CHANGES IN THE DISTRIBUTION OF HETEROTROPHIC BACTERIA IN KAGOSHIMA BAY,
Kagoshima Univ. (Japan). Faculty of Fisheries.
T. Hidaka.
Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 33, No. 1, p 85-96, December, 1984. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Kagoshima Bay, *Japan, *Seasonal distribution, *Heterotrophic bacteria, Bacteria, Seawater, Water pollution, Public health.

Seawater samples were collected from 1m, 25m, 50m, and 100m depth layers at 8 stations along the center line of Kagoshima Bay 17 times in selected seasonal intervals during 1977 to 1984. The heterotrophic bacterial cells in the samples were estimated with the plate count method by surface spreading. The microbial cell counts were most abundant at the inner area of the bay in a horizontal distribution, and were most at the 1m deep layer in vertical distribution. They were more abundant in spring and summer than autumn and winter on a seasonal change basis. The range of bacterial numbers in the seawater samples was 10-1,000 cfu/ml. These results mean that the seawater at the sampling stations of Kagoshima Bay has not been polluted very much as yet. (Author's abstract)
W86-01147

SEASONAL CHANGES IN THE GENERIC COMPOSITION OF HETEROTROPHIC BACTERIA IN SEAWATER OF KAGOSHIMA BAY (IN JAPANESE),
Kagoshima Univ. (Japan). Faculty of Fisheries.
T. Hidaka, and S. Shimazu.
Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 33, No. 1, p 97-105, December, 1984. 67 Fig, 10 Ref.

Descriptors: *Seasonal variation, *Heterotrophic bacteria, *Kagoshima Bay, *Japan, *Bacteria, *Seawater, Fate of pollutants, Pseudomonas, Vibrio, Moraxella, Species composition.

The heterotrophic bacterial flora was sampled in seawater samples collected from the stations of Kagoshima Bay, during 1981 to 1983. The dominant genera in the seawater were Pseudomonas and Vibrio, almost similar to that of open sea water. In the generic compositions, Pseudomonas was the highest in seawater of the inner area of the bay and decreased approaching the entrance; in contrast, the ratio of Vibrio increased. This was confused sometimes, after rainy days, at the stations (St. 3 and 4) near Kagoshima city. In this

case, Moraxella significantly became the most dominant genus, indicating the slight pollution of seawater of this area during a few days. However, the seawater along the center line of Kagoshima Bay was generally not polluted. (Author's abstract)
W86-01148

ECOTOXICOLOGICAL ASPECTS OF PULP AND PAPER MILL EFFLUENTS DISCHARGED TO AN INLAND WATER SYSTEM: DISTRIBUTION IN WATER, AND TOXICANT RESIDUES AND PHYSIOLOGICAL EFFECTS IN CAGED FISH (SALMO GAIRDNERI),
Helsinki Univ. (Finland). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W86-01161

CONSIDERATIONS ON WATER, OIL AND AIR IN POROUS MEDIA,
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
H. O. Schiegg.
Water Science and Technology, Vol. 17, No. 4/5, p 467-476, 1985. 7 Fig, 3 Ref.

Descriptors: *Groundwater pollution, *Porous media, *Oil pollution, Path of pollutants, Observation wells, Aquifers, Capillary height.

Oil spilled above a phreatic aquifer initially percolates primarily vertically until it reaches the capillary fringe. Subsequently, the oil migrates within the capillary fringe parallel to the groundwater table thereby creating an oil-polluted layer parallel to the groundwater table. The mean thickness of such an oil-polluted layer is denoted by H. The average thickness, H, of an oil-polluted layer parallel to the groundwater table is not equal to the thickness of oil in an observation well. H can be described as a function of the mean capillary height for water in air and of the oil potential or the thickness of oil in an observation well. The necessary thickness of oil on water for oil to enter a porous medium equals twice the mean capillary height of the water saturation curve which is encountered by the propagating oil. (Moore-IVI)
W86-01176

FACTORS CONTROLLING THE SURVIVAL OF VIRUSES IN GROUNDWATER,
Arizona Univ., Tucson. Dept. of Microbiology.
M. V. Yates, and C. P. Gerba.
Water Science and Technology, Vol. 17, No. 4/5, p 681-687, 1985. 4 Fig, 4 Tab, 9 Ref.

Descriptors: *Viruses, *Groundwater pollution, Bacteriophage, Temperature effects, Hardness, Hydrogen ion concentration, Nitrates, Ammonia, Turbidity, Dissolved solids, Calcium, Magnesium.

Viral contamination of groundwater is controlled by two major factors: migration and survival. This study used the coliphage MS-2, which is similar in size and structure to many enteric animal viruses, to identify factors which could be used to predict virus survival in groundwater. Groundwater samples collected from throughout the United States were inoculated with the coliphage MS-2 and the rate of virus inactivation determined. All samples were incubated at the temperature of the native groundwater. All samples were analyzed for pH, nitrates, ammonia, turbidity, total dissolved solids, and calcium, magnesium and total hardness. Multiple regression analysis of the chemical variates indicated that temperature and calcium hardness were significantly correlated with the rate of virus die-off. Temperature alone account for 60% of the variation in decay rate. Using all variates, 94% of the variation could be predicted. The presence or absence of microorganisms had an inconsistent effect on the survival of MS-2. (Moore-IVI)
W86-01192

COLLOIDAL STABILITY OF PARTICLES IN LAKES: MEASUREMENT AND SIGNIFICANCE,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W86-01194

SORPTION OF AMMONIA NITROGEN ON RIVER BORNE SUSPENDED SOLIDS,
Purdue Univ., Lafayette, IN. Environmental Engineering Lab.
R. F. Wukasch, and L. P. Moos.
Water Science and Technology, Vol. 17, No. 4/5, p 713-718, 1985. 2 Fig, 5 Tab, 3 Ref.

Descriptors: *Fate of pollutants, *Ammonia, *Sorption, *Suspended solids, Wabash River, Indiana, Desorption, Rivers.

Many of the rivers in the midwestern U.S. carry a fairly high level of suspended solids. The ammonia nitrogen carrying capacity of suspended solids collected from the Wabash River (Indiana) was evaluated. Ammonia nitrogen was found to be both sorbable and desorbable from Wabash River suspended solids collected both in summer and in winter. The sorption of ammonia onto river solids was found to follow a Langmuir model and to be reversible. At background river ammonia concentrations of below about 0.2 mg/l, sorbed ammonia carried by the suspended solids is quite low, less than 0.2 mg NH3-N per gm suspended solids. Near outfalls under the right conditions, as much as 15 to 20% of the ammonia discharged may be initially sorbed from solution to be later released downstream when the soluble ammonia concentration decreases. (Moore-IVI)
W86-01195

HAZARDOUS SUBSTANCES IN WASTE WATER,
Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).
For primary bibliographic entry see Field 5D.
W86-01225

STREAM MODELING OF NONCONVETIONAL WATER QUALITY PARAMETERS: PHENOL, CYANIDE, AMMONIA, OIL AND GREASE,
Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
A. B. M. Shahalam, and D. A. Burke.
Water Science and Technology, Vol. 17, No. 6/7, p 953-966, 1985. 18 Fig, 2 Tab, 3 Ref.

Descriptors: *Phenols, *Cyanide, *Ammonia, *Oil, *Grease, *Stream pollution, *Mathematical models, Fate of pollutants, Decomposition, Multiple regression analysis, Hydraulic transport, Mass balance, Water quality.

Due to complexities in water uses in modern time, water quality management often needs much information in addition to the traditional DO and BOD data, to impose any kind of control on the industrial and municipal discharges into natural streams. The simplistic Monod type of substrate limiting kinetics are not sufficient to express the fate of complex chemicals such as phenol, cyanide, ammonia, oil and grease. This paper presents the kinetics of physical and biological degradation and transformation of such chemicals in natural waters. The kinetics were developed through multiple regression analysis using data monitored over a year from a river in Pennsylvania, USA. The conventional unidirectional hydraulic transport and mass balance equations were then combined with these kinetics to predict the steady state water qualities in various reaches of the river under a specific set of known external discharges. When compared to the monitored water quality data under that specific set of external discharges, the predictions were found to be satisfactory. Some disagreement was observed in cyanide concentrations in the most downstream section of the 25 mile stretch of river. (Author's abstract)
W86-01234

WATER QUALITY MODELLING OF THE LOWER HAN RIVER, KOREA,
Engineering-Science, Inc., Arcadia, CA.
L. F. Tischler, R. M. Bradley, S. J. Park, and D. G. Rhee.
Water Science and Technology, Vol. 17, p 979-990, 1985. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Han River, *Korea, *Wate *Computer models, Wastewater pollut draulic properties, Simulation, Mat models, Urban areas, Model calibration.

The Han River Basin in the Republic covers an area of about 27,000 sq km so Demilitarized Zone, almost one quarter o area of the country. The total populati basin is of the order of 13 million, of wh than 80 percent are concentrated in t conurbation of Greater Seoul alongside t Han River. Within the vicinity of Seoul t used extensively for water supply, irrig both contact and non-water contact Treated nightsoil, untreated sullage, parti ed sewage and industrial wastes genera urban areas are also discharged to the ri is heavily polluted in the downstream re result. The finite difference water qual QUAL-II was adapted to the Lower H using data obtained from extensive fi quality surveys especially designed to p necessary calibration and verification Hydraulic data for the model were obta operation of the U.S. Army Corps of HEC-II computer model. Model calibr verification was confirmed by statistical son of model simulations with the field calibrated model was used to evaluate a different treatment alternatives for two future years. Extensive model sensitivity were run on both the key model paran the treatment alternatives to quantify the of the prediction. (Author's abstract)
W86-01236

TIDAL VARIATION OF SALT FLUX PERSION IN A POLLUTED ESTUARY
Newcastle upon Tyne Univ. (England). Civil Engineering.
For primary bibliographic entry see Field
W86-01238

FACTORS AFFECTING THE ADSO OF COMPLEXED HEAVY METALS DROUS AL2O3,
Delaware Univ., Newark. Dept. of A Engineering.
H. A. Elliott, and C. P. Huang.
Water Science and Technology, Vol. 17 p 1017-1028, 1985. 5 Fig, 1 Tab, 23 grants ENG-77-27379 and ENG-79-1048

Descriptors: *Heavy metals, *Adsorptio na, Fate of pollutants, Copper, Zinc, Lead, Nickel, Calcium, Magnesium, Te effects, Ionic strength.

Factors influencing the adsorption be heavy metals, viz Cu(II), Zn(II), Cd(II), Ni(II), onto Al2O3 from aqueous solutio ing complexing ligands were investig batch adsorption experiments. For th NTA/gamma-Al2O3 system, increasing ionic strength reduced Cu adsorption th tivity coefficient and surface electric layer effects. The presence of alkaline ea (Ca(II) and Mg(II)) also reduced Cu rem solution by lowering the ability of NTA Cu(OH)2 precipitation and through s sorption to the alumina surface. The ad the heavy metals on Al2O3 from solutio ing NTA followed the sequence: Cu > > Pb approximately = Ni. Increase temperature tended to decrease metal a (Author's abstract)
W86-01239

CONTRIBUTION OF AGRICULTURA ING TO EUTROPHICATION IN LAKES,
National Board of Waters, Helsinki (Finl
L. Kauppi.
Water Science and Technology, Vol. 17 p 1133-1140, 1985. 4 Fig, 1 Tab, 15 Ref.

s: *Finland, *Agriculture, *Eutrophica-
ution load, Limiting nutrients, Phospho-
oint pollution sources, Runoff, Desorp-

e accounts for 9 per cent of the total
a of Finland and generates the greatest
ent input to Finnish watercourses. Since
l activity is scattered throughout the
ntry its effects in lakes are less pro-
an those of domestic and industrial ef-
the other hand, point source phospho-
of lakes and rivers decreased signifi-
ng the nineteen-seventies. Phosphorus is
t which primarily limits production in
h lakes. The availability of phosphorus
ral runoff waters is therefore a crucial
the evaluation of the eutrophicating
griculture. The results indicated that in
rs available phosphorus can be 60-70
the total phosphorus. However, the
ns of available P were so low that they
hieved in Finnish lakes of low ionic
n through simple chemical desorption
assistance of the algal uptake. The
f the spring maximum of runoff phos-
akes would thus not depend on the
of the maxima of loading and algal
thor's abstract)

**G WATER QUALITY AND THE EF-
AGRICULTURAL BEST MANAGE-
ACTICES IN THE IOWA RIVER**

chols and Co., Inc., Palo Alto, CA.
bibliographic entry see Field 5G.

**VATER QUALITY IN RELATION
PE, LAND USE AND DISCHARGE
CATCHMENT AREA,**

suniversiteit (Netherlands). Environ-
rch Group.
ner.
e and Technology, Vol. 17, No. 6/7,
985. 6 Fig, 4 Tab, 6 Ref.

*Water quality, *Surface waters,
Land use, *Rural areas, *Flow dis-
ment area, Water pollution sources,
pollution, Base flow, Flood peak,
ents, Drainage, Potassium, Nitrates,
tes, Water quality control.

quality and the factors that influence
igated in a rural area that lies be-
pushed ridge and river backlands.
of soil type, land use and household
the concentrations of nutrients were
base-flow as well as peak-flow peri-
were taken in ditches and canals,
y as discharge increased. Average
base-flow quality in ditches were
soil type and land use and for all
in the canals. The fluctuations of
ere plotted and analyzed in concen-
d concentration-discharge diagrams.
mportance for the quality of total
ie main canal of the loads coming
rts of the drainage basin was inves-
tepwise multiple variable regression
g base-flow situations sources of
e intensively cultivated sandy soils.
concentration of orthophosphate is
ousehold wastewater. During peak-
n and nitrate run off from all soil
ypes of land use, resulting in high
in the surface water, in spite of
nwater. It is concluded that for
nent, intensity of manuring and fer-
decrease, especially on sandy soils.
uld be drained outside the basin, to
entration of orthophosphate. (Au-

**LLUTION OF INTERCITY MO-
OFF WATERS,**

egionaux des Ponts et Chaussees,
Paris (France).
J. D. Balades, M. Cathelain, P. Marchandise, J. Peybernard, and J. C. Pilloy.
Water Science and Technology, Vol. 17, No. 6/7, p 1165-1174, 1985. 10 Tab, 15 Ref.

Descriptors: *Highways, *Runoff, *Water pollution sources, Pollution load, Standards, France, Rainfall, Roads.

From 1980 to 1982, two investigations of the chronic pollution of roadway runoff water were carried out in areas having different pluviometric characteristics. The runoff from two hundred pluviometric events was characterized using highly rigorous methodologies, with a view to estimating the annual pollution load. The annual loads were determined; they show that the (French) official instructions hither-to followed were rather pessimistic. On the other hand, greater vigilance is required as regards the loads that may be contributed by an isolated event, but it is not possible to characterize the parameters that will give rise to such an event. A few rain events can introduce into the environment, in short time, as much as 30% of the annual pollution load of motorway runoff waters. (Author's abstract)
W86-01250

METAL MOBILIZATION IN HOME WELL WATER SYSTEMS IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Inst. for Resource and Environmental Studies.
O. Maessen, B. Freedman, and R. McCurdy.
Journal of the American Water Works Association, Vol. 77, No. 6, p 73-80, June, 1985. 2 Fig, 4 Tab, 41 Ref.

Descriptors: *Well water, *Nova Scotia, *Metals, *Plumbing, Pipes, Metal mobilization, Water quality, Drinking water, Copper, Zinc, Lead, Cadmium, Heavy metals, Leaching.

A study of private wells in rural Nova Scotia found that concentrations of metals such as cadmium, zinc, copper, and lead increased in water that remained in the distribution system overnight. Metal mobilization of copper, lead, and zinc occurred in significant amounts from the plumbing systems of the homes sampled. In many cases this leaching caused concentrations of copper and lead to be in excess of the recommended Canadian drinking water limits within only a few hours of standing in the water pipes. Water samples containing copper and lead concentrations in excess of the recommended limits were obtained from a large proportion of the homes sampled in each of the four communities studied. The amount of metal mobilization varied greatly from house to house but, on average, the absolute amount of metal mobilization did not differ among the homes in the four communities. Correlation analyses helped to confirm that indexes commonly used to assess the corrosive tendency of a water were not good predictors of the degree of metal leaching that could occur in a given water. Stepwise multiple regression analyses helped to identify 12 water chemistry variables as being related to the degree of metal mobilization observed. These were potassium, sodium, calcium, magnesium, and manganese; the chloride, nitrate, hydrogen and sulfate ions; and dissolved oxygen, and conductivity. No obvious generalized relationship was found between the pH of the water and the degree of metal leaching. Because of the high concentrations of copper and lead found in samples of standing water it is recommended that residents in homes with metal piping allow the water in the pipes to flush for several minutes before use in the morning or if the water has not been used for several hours. (Baker-IVI)
W86-01264

NITROGEN TRANSFORMATIONS IN THE BALTIC PROPER: DENITRIFICATION COUNTERACTS EUTROPHICATION,
Goeteborg Univ. (Sweden). Dept. of Microbiology.
U. Ronner.
Ambio, Vol. 14, No. 3, p 134-138, 1985. 4 Fig, 2 Tab, 39 Ref.

Descriptors: *Baltic Sea, *Nitrogen, *Eutrophication, *Denitrification, Water pollution, Nitrogen removal, Marine environment, Fate of pollutants, Bacteria, Phytoplankton.

Nitrogen plays an important role in marine eutrophication and its increased addition to the Baltic Sea by human activities could upset the ecosystem if its loss from the system is also not substantial. The major process of nitrogen loss is denitrification, a bacterial process that converts nitrate to nitrogen gas during anoxic or near-anoxic conditions. A budget is presented which is based on rate measurements for many processes and gives improved estimates for denitrification. A general diagram of the nitrogen flow in the Baltic ecosystem is pictured. Inputs to the Baltic proper include atmospheric deposition, river runoff, diffusive and advective transport - external, and nitrogen fixation. Nitrogen transformations within the Baltic proper include phytoplankton biomass and assimilation, microbial biomass and mineralization, nitrification, and diffuse and advective transport - internal. Outputs from the Baltic proper include nitrogen gas, immobilization, transport by surface currents, and emission of nitrous oxide to the atmosphere. The controlling factors for denitrification below the halocline of the Baltic are clearly oxygen and nitrate, while denitrification above the halocline probably is stimulated by increasing amounts of nitrate from land. In the Baltic proper today, organic nitrogen seems so far to be efficiently transformed, via ammonium and nitrate, to nitrogen gas. Thus denitrification seems to be preventing excessive eutrophication by removing nitrogen, the limiting nutrient for primary production. The reported budget illustrates the potential importance of denitrification in controlling eutrophication in the Baltic, and emphasizes the necessity for further studies in this area. (Baker-IVI)
W86-01278

INDICATIONS OF THE CAPACITY FOR RAPID REVERSIBILITY OF LAKE ACIDIFICATION,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
C. Forsberg, G. Morling, and R. G. Wetzel.
Ambio, Vol. 14, No. 3, p 164-166, 1985. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Acid lakes, *Acidification, *Acid rain, *Sulfates, *Sweden, *Water pollution effects, Water pollution sources, Hydrogen ion concentration, Nitrous oxides, Lakes.

Acidification in a number of lakes in western Sweden reached a maximum during the middle of the 1970s, with sulfate concentrations of 270 to 290 micro-eq/l and pH values of 4.4 to 4.5. In 1977 this trend reversed, and decreases in the concentrations of sulfate and hydrogen ions were observed. The main reason for this partial improvement, 0.3 to 0.4 pH units at most, was a decrease in wet deposition of sulfate; the observed decrease was about 20 percent at the meteorological sampling location Bohus Malmon, in western Sweden. In contrast to the wet deposition of sulfate, the wet deposition of hydrogen ions increased, probably as a result of increased emissions of nitrous oxides. A sulfate reduction of 40-100 micro-eq/l was found for several lakes. There was a correlation between sulfate and H(+) during both the acidification and deacidification phases. Of special interest is the hysteresis that occurs between these phases. When sulfate concentrations had decreased to previous levels, H(+) values were higher than during the acidification phase. Increased precipitation, which was also more acid, counteracted the improvements obtained by reduced sulfate concentration. It was concluded that sensitive lakes appear able to begin recovery quickly when sulfate concentration are reduced. (Author's abstract)
W86-01279

BIOSPHERE LEVELS OF CADMIUM, ZINC AND COPPER AROUND AN OLD SWEDISH COPPER MINE,
Linkoeping Univ. (Sweden). Dept. of Pharmacology.
For primary bibliographic entry see Field 5C.

W86-01280

MULTIVARIATE ANALYSIS OF WATER CONTAMINATION BY HEAVY METALS AT DONANA NATIONAL PARK,
Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Inst. de Quimica Organica General.
J. Gonzalez, L. M. Hernandez, A. Hernan, and G. Baluga.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, p. 266-271, August, 1985. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Heavy metals, *Donana National Park, *Water pollution sources, *Mines, Multivariate analysis, Mathematical studies, Cadmium, Mercury, Lead, Copper, Zinc.

Donana National Park (Spain) is a natural park about 60,000 Ha in size. It is a very important stopping ground and winter habitat for migratory birds that breed in northern Europe. One of the most important water supplies for the survival of the park is the Guadiamar River. The Agrio river is a tributary of the Guadiamr, and it flows across an important mining field which is currently in operation. The watershed was sampled to determine whether there was any possible contamination from the mining. Sampling points were located in the mining area, the marshes, and the stabilized sands. Cd, Pb, Cu and Zn pollution were found in the waters of the study area. Contamination was highest in the mining area, high in the northern side of the marshes, moderate in southern site of the marshes, and low in the stabilized sands. This conclusion is linked with the fact that the hydraulic system of the stabilized sands is independent from that of the marshes. The stabilized sands only depend on the rain and the subterranean waters. High Hg pollution was found throughout the area studied. (Baker-IVI)
W86-01286

BROMINATED PHENOLS AND ANISOLES IN RIVER AND MARINE SEDIMENTS IN JAPAN,
Osaka Prefecture Inst. of Public Health (Japan).
I. Watanabe, T. Kashimoto, and R. Tatsukawa.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, p 272-278, August, 1985. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Phenols, *Anisoles, *Sediments, *Japan, Fate of pollutants, Organic compounds, Marine sediments, River sediments, Halogenated hydrocarbons, Tribromophenol, Tribromoanisole.

The environmental levels of brominated phenols have been determined along with chlorinated phenols in river and marine sediments collected from Osaka, Japan. The brominated and chlorinated anisole levels in the samples were also examined. At site no. 7 brominated phenols, were found in the samples along with chlorinated phenols. No dibromophenol was found. Also present in the sediment samples was 2,4,6-tribromoanisole along with chlorinated anisoles. The residue levels of halogenated phenols and anisoles in the sediment samples are given as determined on a dry weight basis. The brominated phenol levels were lower than those of the chlorinated phenols being about one-tenth the chlorinated phenols content. Tribromophenol was found in nearly all the samples analyzed and was thus considered an ubiquitous environmental contaminant, though its residue level is generally low. However, higher residue levels of this compound were found in the two sediment samples collected at sites 7 and 8, and were nearly the same as those of the organochlorinated pesticides. 2,4,6-Tribromoanisole was found in only two of the 12 samples analyzed and had a very low residue level. Other brominated anisoles were absent from the samples. Brominated phenol residue levels in sediment samples collected at sampling sites 7 and 8 were considerably higher than those collected at other sites. Sewage treatment plants were located in the vicinity of sampling sites 7 and 8. (Baker-IVI)
W86-01287

CALIBRATION OF A MASS TRANSPORT MODEL USING ENVIRONMENTAL TRITIUM,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
J. C. Herweijer, G. A. Van Luijn, and C. A. J. Appelo.
Journal of Hydrology, Vol. 78, No. 1/2, p 1-17, May, 1985. 10 Fig, 14 Ref.

Descriptors: *Mass transport models, *Model studies, *Tritium, *Aquifers, Isotope studies, Path of pollutants, Groundwater contamination, Animal wastes.

Tritium profiles of groundwater were obtained by detailed vertical sampling of a 20-m thick aquifer comprising fluvioglacial sediments in the central part of The Netherlands. Using the known environmental tritium input time series since 1951, these profiles were used to calibrate the Random Walk model of T.A. Prickett et al. To perform this procedure the model was modified to allow vertical use and a time-dependent non-instantaneous input of a decaying radioactive tracer. During this calibration the following parameters were varied: (1) geological geometry (position and extent of a clay lens); (2) permeability variations; (3) ratio of net precipitation and effective porosity; and (4) longitudinal and transverse dispersivity. The calibrated model was hence used to predict the flushing of manure contamination from the aquifer. The applied calibration technique has proved useful to test and roughly calibrate the hydraulic properties estimated from the logs of a limited number of borings, with the accuracy needed for mass-transport modelling. Compared with the very detailed drilling program that is usually required to obtain such detailed information, this tritium-based calibration seems competitive for shallow phreatic aquifers. (Author's abstract)
W86-01289

SALT-WATER-FRESHWATER TRANSIENT UPCONING - AN IMPLICIT BOUNDARY-ELEMENT SOLUTION,
Kansas State Geological Survey, Lawrence.
M. Kemblowski.
Journal of Hydrology, Vol. 78, No. 1/2, p 35-47, May, 1985. 10 Fig, 13 Ref. U.S. Department of Interior, Bureau of Reclamation grant 4-FG-93-00080.

Descriptors: *Saline water intrusion, *Saline-freshwater interfaces, *Upconing, *Implicit solutions, *Boundary element solutions, Boundary conditions, Aquifers, Groundwater contamination, Model studies.

The most difficult part of the modeling of salt-water intrusion is the simulation of the motion of the transition zone between fresh and salt water. If the width of the transition zone is relatively small compared to the aquifer thickness, the sharp-interface approximation may be introduced. The boundary-element method was used to solve the set of partial differential equations describing the flow of salt water and fresh water separated by a sharp interface in the vertical plane. In order to improve the accuracy and stability of the numerical solution, a new implicit scheme was developed for calculating the motion of the interface. The solution does not use the Dupuit approximation, thus providing a better model for the cases in which the vertical component of the flow is significant. For the simulation of the interface motion, a special implicit scheme was developed, which gives substantially better results than the explicit solution. The performance of this scheme was tested by means of numerical simulation. The numerical results were compared to experimental results for a salt-water upconing under a drain problem. The numerical model may be used to analyze steady and unsteady, stable and unstable, salt-water upconing problems. (Collier-IVI)
W86-01291

MODELLING NON-POINT SOURCES OF NITRATE POLLUTION OF GROUNDWATER IN THE GREAT OUSE CHALK, U.K.,
Birmingham Univ. (England). Dept. of Geological Sciences.
M. A. Carey, and J. W. Lloyd.
Journal of Hydrology, Vol. 78, No. 1/2, p
May, 1985. 8 Fig, 3 Tab, 32 Ref.

Descriptors: *Model studies, *Nonpoint po
sources, *Groundwater contamination, *N
*Great Ouse Chalk, *Cambridge, *Englan
of pollutants, Solute transport, Nutrients.

A numerical distributed transport model w
to simulate nitrate concentrations in groun
The model takes into account the nitrat
from the soil zone and the movement of ni
the unsaturated and saturated zones. The
was developed for an area of 600 sq km
Cretaceous Chalk, near Cambridge, Englan
model area is described in terms of geolo
drogeology, land use and agricultural p
The Chalk aquifer was represented by rect
cells which are divided into an upper and
layer to represent the unsaturated and sa
zone. The nitrate input from the soil zo
calculated. A simplified equation was used
count for the delay for nitrate to pass thro
unsaturated zone. Nitrate concentratio
groundwater were determined using a m
ance approach. The model results in the sim
mode and in the forecast mode are presen
discussed and the sensitivity of the model i
ined. (Author's abstract)
W86-01294

**QUALITY OF WATER IN AN AQUIFE
ITS MANIFESTATION IN PUMPING W**
Universidad Nacional Autonoma de
Mexico City. Inst. de Fisica.
For primary bibliographic entry see Field 2
W86-01299

**ANALYSIS OF ORGANICALLY COMPL
ELEMENT CONTENTS IN SEDIMENT
SLUDGES (ZUR ANALYTIK ORGA
KOMPLEXIERTER ELEMENTGEHAL
SEDIMENTEN UND SCHLAMMEN),**
Goettingen Univ. (Germany, F.R.). Inst. f
organische Chemie.
For primary bibliographic entry see Field 7
W86-01301

**NEW METHOD OF CONTAMINANT P
ANALYSIS,**
Texas A and M Univ., College Station. D
Geology.
P. A. Domenico, and G. A. Robbins.
Ground Water, Vol. 23, No. 4, p 476-48
August, 1985. 10 Fig, 11 Ref.

Descriptors: *Plumes, *Path of pollutants,
studies, Water analysis, Computers.

A methodology is presented which may b
in the analysis of contaminant plumes. The
tions are relatively straightforward and eas
grammed for microcomputer analysis,
model can be manipulated to account for
spreading geometries. Most importantly, i
tion on seven potential unknowns can be e
directly from the concentration distributio
by providing a better physical basis for the
Such procedures remove much of the non
ness associated with contaminant plume
As the information for the analysis is taken
off the plume, the method can be applied to
cally retarded species without any regard t
dation coefficients. The model has lim
common to all analytic expressions, nam
isotropic and homogeneous assumption
with an assumed constant velocity syste
data demands are rather large, and the cal
procedure discussed should be viewed as a
estimate based on an extended pulse approx
that realistically cannot be expected to ade
describe all portions of a plume. (Baker-IV
W86-01309

**MOVEMENT OF VOLATILE ORG
THROUGH A FRACTURED ROCK AQ**
Geological Survey, Trenton, NJ. Water Re
Div.

/d.
Water, Vol. 23, No. 4, p 496-502, July-985. 5 Fig, 13 Ref.

rs: *Volatile compounds, *Chlorinated ons, *Path of pollutants, *Groundwater *New Jersey, Aquifers, Geological frac-er pollution control, Pumping.

assessment or the movement of volatile hrough the Brunswick fractured rock s undertaken in response to the detection nants in several municipal water supply northern New Jersey community. Com-a manufacturer of cutting tools and has is volatile organics including 1,1,1-trich- in its manufacturing process. Company involved in the distillation and repack-arious laboratory reagents and clinical ncluding many volatile organics such as and carbon tetrachloride. Contami-Company A and B were transported through the overburden to the water iltrating precipitation. The volatile or-ounds with relatively higher specific vere transported downward to the Aquifer much more readily than those with lower specific gravities. A pump-e program helped control the spread of on. The water quality patterns con-the plumes were being captured by the lepression surrounding the pumping very low levels were found southwest- pumping wells. Both Company A and rces of the trichoroethylene found in The wells oriented along strike with were mainly contaminated by 1,1,1-ane and tetrachloroethylene with r concentrations of chloroform and chloride. Therefore, Company A was l source of the 1,1,1,-trichloroethane roethylene found in the aquifer. The ed along strike with B were mainly l by chloroform and carbon tetrachlo-ch lower concentrations of 1,1,1-trich-nd tetrachloroethylene. Although lim-t, some contaminated ground water n directions other than directly along ally near the pumping wells. (Baker-

G VERTICAL SOIL MOISTURE LAND TREATMENT SITE,
niv., Santa Cruz. Dept. of Applied

bibliographic entry see Field 2G.

SALT-WATER MOVEMENT IN ON LUANG AQUIFER, BANGKOK,
Tech., Bangkok (Thailand). Div. of ces Engineering.
ibliographic entry see Field 2F.

s Of Pollution

KTON DYNAMICS IN A HYPER-ACKISH-WATER BAY,
(Finland). Dept. of Limnology.

nternationale Vereinigung Limnolo-No. 4, p 2203-2207, 1985. 3 Tab, 20

*Phytoplankton, *Brackish water, es composition, *Kaupunginselka den, *Poorvoo, *Finland. *Physico-aracteristics, Cyanophyta, Algal ss, Phytoplankton, Water tempera-nce, Nutrients, Water pollution ef-ency.

onships among phytoplankton com-sition, phytoplankton biomass, pri-vity in vitro, water temperature, linity), freshwater influx, and nutri-

ent levels were examined in Kaupunginselka Bay (Stadsfjarden) at Poorvoo, Finland. The bay is a shallow, sewage-polluted, brackish embayment at the mouth of the River Porvoonjoki (Borga River), in which the growth of Oscillatoria agardhii has been a problem. Linear correlation coefficients were calculated among various phytoplankton and physicochemical parameters. For blue-green algae, nutrients and salinity were the main factors influencing biomass variations, whereas for green algae and diatoms, water temperature and salinity, respectively, appeared to be key factors. The factors influencing primary productivity reflected the Cyanophycean dominance of the phytoplankton. Freshwater discharge into the bay influenced phytoplankton through its effect on the rate of water renewal. A very significant correlation was seen between phytoplankton biomass and residence time of water in the bay (r=0.726**). The Cyanophycean dominance in the bay was partly due to low light environment; the Secchi disk transparency of 0.10-0.25 indicated a light environment favorable to 'shadow plants' like O. agardhii. Low correlation coefficients were exhibited by numerous environmental factors, which makes it impossible to select a key factor regulating phytoplankton succession in this area. (Rochester-IVI)
W86-00932

PATTERN RECOGNITION TECHNIQUES TO DETERMINE BENTHIC INVERTEBRATE TROPHIC AND COMMUNITY RESPONSES TO INDUSTRIAL INPUT,
Beak Consultants Ltd., Calgary (Alberta).
R. A. Crowther, and M. E. Luoma.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2226-2231, 1985. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Thunder Bay, *Ontario, *Ecological impact, *Water pollution effects, *Benthos, *Pulp and paper industry, Industrial wastewater, Species composition, Statistical analysis, Species distribution, Phenols, Oligochaetes, Midges, Mollusks.

The pattern recognition techniques of reciprocal averaging ordination (RAO) and discriminant analysis (DA) successfully defined the extent of, and placed boundaries between, areas of chronic and acute pollution associated with pulp and paper mill effluent in Lake Superior. Sediments of the near-shore environment of Thunder Bay, Ontario, Canada were sampled with an Ekman grab with the intention of assessing the appropriateness of a proposed limited use zone (LUZ), which had originally been established solely on the basis of phenolics concentration. The benthic fauna generally was dominated by Oligochaeta, Chironomidae, and Mollusca. Five sequences of benthic fauna were identified by RAO and DA; the sequences appeared to represent a trophic gradient from mesotrophy through eutrophy to chronic pollution. The principal causative agents for the observed faunal patterns were concentration gradients in dissolved solids, phenolics, wood fiber, and dissolved oxygen content. In comparison with the LUZ originally proposed, the area of actual system perturbation as shown by the benthos was much larger, although the area of chronic pollution effects was small. The proposed LUZ consisted of a roughly rectangular area extending 700 m offshore and about 1,200 m wide. The zone of influence according to benthos analysis indicated an irregularly-shaped zone of influence extending 1,300 m offshore with a width of 2,800 m. Numerical indices alone probably would not have yielded the results obtained in this study; ecological information and the pattern expressed by the fauna should be incorporated in studies of system perturbations. (Rochester-IVI)
W86-00934

ASBESTOS FIBERS IN LAKES AND STREAMS,
Vermont Univ., Burlington. Dept. of Zoology.
E. B. Henson.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2232-2237, 1985. 3 Fig, 16 Ref.

Descriptors: *Asbestos, *Water pollution effects, Chrysotile, Daphnia, Paramecia, Water analysis, Physical analysis, Microscopic analysis.

Chrysotile is the most common species of asbestos; literature on asbestos is voluminous, but little has been reported on the effects of this mineral on plants and animals in aquatic ecosystems. Several methods have been used for measuring the asbestos fiber content of water, including colorometric tests, light microscopy, polarized light microscopy, dispersion staining, x-ray diffraction, proton-induced x-ray emission, transmission electron microscopy, scanning electron microscopy, and selected area electron diffraction. Laboratory procedures for asbestos present problems because water acidity, high alkalinity, and methods of handling affect the size, and hence number, of fibers in a water sample. Concentrations of asbestos reported in natural waters range from undetectable (non-contaminated parts of Lake Champlain (USA)) to 1.200 x 10 to the 9th power/liter in water draining mines from the city of Asbestos, Quebec. In laboratory experiments, survivorship of Daphnia pulex was negatively correlated with concentration of chrysotile fibers over the range of approx 20-550 mg/l. Autopsies of the animals that died showed a clumping of fibers and congestion around the antennal setae and legs, which may have restricted swimming, and there was some evidence that the animals were impaled during feeding. Similar experiments with Paramecium in culture at various concentrations of asbestos fibers revealed no difference between controls and experimental cultures in terms of growth rate or asymptotes. (Rochester-IVI)
W86-00935

DIATOM COMMUNITIES OF THE POLLUTED RIVERS OF CENTRAL POLAND (LES COMMUNAUTES DES DIATOMEES DANS LES RIVIERES POLLUEES DE LA POLOGNE CENTRALE),
Lodz Univ. (Poland). Inst. of Environmental Biology.
B. Rakowska.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2319-2322, March, 1985. 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Diatoms, *Water pollution effects, *Rivers, *Poland, Headwaters, Downstream, Ecological distribution, Industrial wastewater, Food processing industry, Bioindicators, Wastewater pollution.

Qualitative and quantitative analysis of the diatoms found in polluted rivers in Central Poland reveals that a small number of species are characteristic of the headwaters, and the number of species increases downstream. The rivers are polluted in the upper sectors. The influence of pollution on the diatom communities is evident in the river Bzura where the number of taxons are reduced two-fold and the number of individuals is reduced 100-fold. Downstream, the number of taxons and individuals increases with the improvement in physical and chemical conditions. In the rivers Rawka and Mroga, there is a simultaneous reduction in the number of taxons and the density of diatoms downstream of the point of introduction of effluents from the food processing industry. Analysis of the diatoms communities led to the establishment of a list of typical species for waters of different degrees and types of pollution; species are listed which have a great tolerance for physicochemical gradients. (Moore-IVI)
W86-00947

INFLUENCE OF ORGANIC POLLUTION ON THE MACROINVERTEBRATE COMMUNITIES OF MOUNTAIN STREAMS,
Innsbruck Univ. (Austria). Inst. fuer Zoologie.
M. Margreiter-Kownacka.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2324-2326, 1985. 1 Fig, 9 Ref.

Descriptors: *Organic matter, *Water pollution effects, *Mountain streams, *Macroinvertebrates, *Poland, *Sucha Woda, *Roztoka, *Rybi Potok, *Gurgler Ache, *Austria, Ecological effects, Phys-

icochemical characteristics, Benthos, Alpine regions.

Faunal composition in relation to pollution level was compared in the Tatra (Poland) streams Sucha Woda, Roztoka and Rybi Potok, and the alpine stream Gurgler Ache (Austria). The method employed included a detailed description of the stream or river and its basin, selection of research localities, a detailed description of the locality and its physico-chemical conditions, and standardization of sampling technique throughout. The dominant groups of macrofauna in the upper courses are Chironomidae (mainly Orthocladiinae in the Tatra springs and streams and Diamesinae in the alpine glacier-streams) and Ephemeroptera (mainly Baetis alpinus). Plecoptera constitute an av 5%. In the lower courses of the alpine streams Trichoptera play an important role. Under the influence of pollution the structure of the community changes. The influence occurs seasonally in Gurgler Ache where tourists are present mainly in winter. At a station on this stream where tourist influence was present, Ephemeroptera were a smaller part of the percentage composition and Chironomidae and Oligochaeta were a much larger part, than at another, unpolluted station. Plecoptera were also much less abundant at the polluted station, particularly in winter. (Rochester-IVI)
W86-00948

INFLUENCE OF THE SEWAGE TREATMENT PLANT EFFLUENTS ON THE STRUCTURE OF THE BENTHIC COMMUNITIES OF LAKE OF GENEVA,
Geneva Univ. (Switzerland). Unite de Biologie Aquatique.
B. Crozet.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2327-2331, 1985. 2 Fig, 16 Ref.

Descriptors: *Benthos, *Lake Geneva, *Switzerland, *Wastewater pollution, *Water pollution effects, Stones, Nutrients, Dreissena, Gammarus, Midges, Trichoptera, Caenis, Tanytarsids, Tubificids, Pisidium, Orthocladiinae, Dugesia, Pentaneurini, Lynaea, Spaerium, Naididae, Asellus, Valvata, Procladius, Psychodidae, Turbidity, Ammonia, Nitrates, Phosphorus.

The influence of the effluent from two small sewage treatment plants (STPs) (3,000 population equivalents) on the stony littoral zone fauna of Lake Geneva was apparent in faunas collected by gathering stones from the bottom. The diversified community of the unaffected area was characterized by Dreissena polymorpha, Gammarus sp., and Chironomids. Numerous other taxa were present. Under the influence of STP outflows, D. polymorpha, Gammarus sp, Hirudinea (2 spp), Trichoptera larvae (6 spp), Caenis horaria, and Tanytarsids exhibited declines; turbidity, NH4, NO3, total P, and total insoluble matter increased around STP outfalls. Groups exhibiting increases in numbers at STP outfalls were Tubificids, Pisidium sp, Orthocladiinae, Chironomids, Dugesia sp, Pentaneurini sp, Lymnaea auricularia, and Sphaerium corneum. Naididae and Asellus aquaticus populations tended to remain unchanged. New members of the fauna near the STPs were Valvata piscinalis, Procladius choreus, and Psychodidae larvae. The effluents cause two main modifications that affect the benthic community: (1) the substratum becomes more homogeneous as insoluble organic matter partially or totally covers the stones, and (2) the wastewater effluents modify the available food by eliminating the epilithic algae, resulting in declines in herbivorous organisms and adaptation by omnivorous invertebrates (L. auricularia, A. aquaticus). (Rochester-IVI)
W86-00949

DIATOM FLORA OF THE LLOBREGAT RIVER AND ITS RELATION TO WATER QUALITY,
Barcelona Univ. (Spain). Dept. de Ecologia.
For primary bibliographic entry see Field 2H.
W86-00950

MULTILEVEL APPROACH TO THE ASSESSMENT OF ECOTOXICOLOGICAL EFFECTS IN A HEAVY METAL POLLUTED STREAM,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
P. J. Sheehan, and A. W. Knight.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2364-2370, 1985. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Toxicity, *Heavy metals, *Water pollution effects, *Copper, *Zinc, *Little Grizzly Creek, *Plumas County, *California, Fish, Trout, Stoneflies, Mayflies, Caddisflies.

Copper and zinc pollution emanating from an abandoned mine appears to account for the absence of fish and many invertebrates in Little Grizzly Creek, Plumas County, California. No fish were found (by electroshock) in pools at contaminated sites, but populations of rainbow trout and brook trout were abundant in pools above the polluted zone. Stonefly and mayfly nymphs were absent or rare, generally less than 5% of total individuals, and caddisflies made up less than 10% of pooled annual samples, from contaminated sites. The most striking feature of the polluted zone was the overwhelming numerical predominance of chironomid collector-gatherers in invertebrate collections and the rarity of large predatory or omnivorous species. In situ toxicity bioassays showed that summer concentrations of copper at the least contaminated of the affected sites (20-320 micro-g/l Cu) overlap LC50 values for rainbow trout fry within an acute exposure period (about 5-100 hr), a finding which seems to account for the failure of trout to survive in the stream. Stonefly (Doroneuria) nymphs were less sensitive to the mine effluent: 36% mortality was observed in 96 hr at the most contaminated site (1,700 micro-g/l Cu). Evidently other factors than acute toxicity, such as long-term effects or low prey density, account for the absence of Doroneuria in Little Grizzly Creek. Although chironomids dominated numerically at the contaminated sites, fewer genera were present there than in the reference samples. Furthermore, there was a relative absence of < 2 mm size-class individuals, suggesting serious impairment of recruitment at least two of the polluted sites. This effect was confined mainly to the fall season at the third polluted sampling site. (Rochester-IVI)
W86-00953

CHARACTERISTIC DISTRIBUTION OF CHIRONOMIDS IN THE RIVERS POLLUTED WITH HEAVY METALS,
National Inst. for Environmental Studies, Tsukuba (Japan).
M. Yasuno, S. Hatakeyama, and Y. Sugaya.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2371-2377, 1985. 3 Tab, 16 Ref.

Descriptors: *Midges, *Heavy metals, *Bioaccumulation, *Water pollution effects, *Japan, *Yoshino, *Mazawa, *Senasaka, Metals, Cadmium, Copper, Lead, Zinc, Ecological effects, Species composition, Animal tissues.

Chironomids collected in three second-order streams, tributaries of the River Mogami, Yamagata Prefecture, Japan, included three taxa that may be tolerant of heavy metal pollution. The three streams, Yoshino, Mazawa, and Senasaka, receive effluent containing Cd, Cu, Pb, and Zn from abandoned copper mines. A total of 60 species of chironomids were recovered from the three streams. Orthocladiinae had the greatest number of species (35); Chironominae had 15 species. Three species of Orthocladiinae, Eukiefferiella sp A, Orthocladius sp A and Cricotopus sp, were common in all three streams, although the streams are more than 30 km apart. Tolerance of heavy metal pollution appeared to be in the order Eukiefferiella sp A > Orthocladius sp A > Cricotpus sp; none could tolerate the conditions at one station on the River Senasaka, where 1,067 micro-g/l Cu and 2,345 micro-g/l Zn were found in water of pH 4.6. Eukiefferiella sp A, Orthocladius sp A, and Polypedilum sp all accumulated heavy metals in their tissues, although the number of times the river water concentration in their tissues varied by species and by location. For example, Eukiefferie A accumulated Cd 660 times on a dry weight on the other hand, Polypedilum sp, in a pond 2.2, with a copper concentration of 8,498.0 g/l, accumulated far less Cu (24.8 micro-g/ weight) than Eukiefferiella sp A (1,816.0 mic g dry weight) in water of much lower conc tion (48.4 micro-g/l). The three species of C cladiinae were identified as indicators of metal pollution; they may be new specie specific to such environments. The chiron inhabiting the regions polluted with heavy seem to have the ability not to uptake the metals or to excrete them rapidly. (Rochester
W86-00954

EFFECTS OF HEAVY METALS ON NIT CATION STUDIED WITH CHEMO TECHNIQUE,
Uppsala Univ. (Sweden). Limnologiska I tionen.
K.-O. Waara, and A. Wilander.
Verhandlung Internationale Vereinigung Lim gie, Vol. 22, No. 4, p 2378-2382, 1985. 3 Fig, 12 Ref.

Descriptors: *Heavy metals, *Nitrification, mostats, *Bacteria, Copper, Zinc, Cadmium, Metals, Growth, Toxicity, Water pollution e

Nitrite oxidation by the bacteria of an ino from a sewage treatment plant tolerated metal concentrations high above natural ground values at pH 7 in a nitrite-poor medi chemostats. Copper at 10 micro-g/l induced a 5% decreased in activity; addition of 25 mic l Cu resulted in a slowly decreasing activity stabilized at about 50% of the control leve response to 55 micro-g/l Cu was an imm 50% inhibition, followed by a gradual incre 80% inhibition. The effect of 75 micro-g/l C almost total inhibition initially, followed by covery from days 6-11, but with inhibition 95% for days 13-19. Inhibition of nitrificatio Cd required higher concentrations, as follo micro-g/l, < 10%, 100 micro-g/l, 25%, 330 g/l 55%, 520 micro-g/l, 85%; 4 mg/l, 90%; mg/l, 90%. Various concentrations of Pb u mg/l gave no inhibition of nitrification, but tion increased to from 10% to 90% between 1.7 mg/l, respectively. Zinc addition gave less inhibition for concentrations through 0.5 but inhibition was 10% at 1 mg/l and 80% mg/l. The order of toxicity was: Cu > Cd > Zn. (Rochester-IVI)
W86-00955

CR6+ INFLUENCE UPON EPHEME TERA LARVAE IN A PRE-ALPINE TORR
Milan Univ. (Italy). Ist. di Biologia.
M. C. Ramusino, and G. Pacchetti.
Verhandlung Internationale Vereinigung Lim gie, Vol. 22, No. 4, p 2383-2384, 1985. 1 Fig,

Descriptors: *Aquatic insects, *Chro *Larvae, *Alpine regions, *Mountain st *Grua, *Agogna, *Borgomanero, *Italy, To Water pollution effects, Benthos, Metals, metals, Streams.

Benthic Ephemeroptera were adversely af by pollution of an alpine stream (Grua, flows into the Agogna, near Borgomanero, and did not recover in the year following in tion of a purification plant. Chromium levels elevated in the stream, with only 3/33 sa having values lower than 0.05 mg/l. Other cal and chemical factors did not seem to volved in the decrease in the number of Eph optera species that was apparent betwee stream, unpolluted stations, and those downs from the wastewater effluent. Epeorus torre Rhitrogena semicolorata, Habrophlebia umb and Ecdyonurus helveticus seemed to be sensitive; Baetis gemellus and B. rhodani most resistant. Although dissolved Cr(6+ creased going downstream, the general be conditions did not improve, and almost all s underwent a substantial decrease. The patte decrease in abundance were similar befor after installation of the purification plant. (R ter-IVI)

956

UM AND CHROMIUM IN THE
S, SEDIMENTS AND BIOTA OF THE
ARMA RUNNING WATER ECOSYS-

niv. (Italy). Ist. di Ecologia.
ary bibliographic entry see Field 5B.
57

ASTE DISCHARGE RICH IN COPPER
XAMPLE OF EFFECTS ON PLANK-
OMMUNITIES,
Nacional de Investigacao des Pescas,
ortugal).
a, T. Monteiro, C. Cabecadas, C. Vale,
Brogueira.
ung Internationale Vereinigung Limnolo-
22, No. 4, p 2395-2404, 1985. 5 Fig, 5 Tab,

rs: *Mine drainage, *Copper, *Water
effects, *Portugal, *Rabagao River,
agao, *Venda Nova, *Salamonde, *Phy-
, *Zooplankton, Sediments, Dissolved
utrients, Metals, Ecological effects.

on of the biotic and chemical character-
hree reservoirs, Alto Rabagao, Venda
Salamonde, which are in a downstream
he Rabagao River, north Portugal, sug-
the phytoplankton community has
apted to high copper concentrations, but
oplankton community is adversely af-
rticularly at the herbivorous level.
he three reservoirs are well oxygenated,
nely low alkalinity and hardness, a pH
eutrality, and are nutrient-poor with a
organic content. Mine effluent enters
va reservoir at its downstream end.
sediments of Venda Nova ranges from
0 ppm, with the highest concentration
ine effluent source. Concentrations of
opper are also higher in Venda Nova
90 nanomole (nmol)/kg in the area of
nt Cu concentration down to 80 nmol/
m the mine input) than in Alto Raba-
= 60 nmol/kg) or Salamonde (mean =
). A strong reduction in plankton spe-
ple and in density was observed in the
da Nova where Cu in water and sedi-
igh; a shift in community composition
to one dominated by Cosmarium tinc-
lla valga, and Tropocyclops prasinus.
tinctum dominated in the unpolluted
reservoir as well, whereas replacement
hnia quadrangula and Keratella coch-
. valga occurred under the highest
n. The effects of contamination by
apparent in data on percentage simi-
efficient of community, but the Shan-
diversity index was sensitive for zoo-
y. (Rochester-IVI)

PARTITIONING AND RELATED
N PARASITIZED AND NON-PARA-
OSQUITOFISH (GAMBUSIA AF-
CILIIDAE),
te Univ., East Lansing. Pesticide Re-
r.
nd D. H. Smith.
Internationale Vereinigung Limnolo-
No. 4, p 2405-2412, 1985. 1 Fig, 4 Tab,

*Fish physiology, *Mosquitofish,
Parasites, *Toxicity, Animal physiol-
pollution effects, Metals, Heavy
Embryos, Bioaccumulation.

of low-level cadmium exposure and
completely blocked reproduction in
in what appeared to be a synergistic
embryos were observed only in non-
lividuals among those exposed to Cd.
ed mosquitofish and mosquitofish
ith metacercaria of Diplostomulum
rematoda: Strigeidae) were exposed
0.02, 2.3, 3.1, 5.6, and 7.5 micro-g

Cd/l added as CdCl2 in a continuous flow system. Cadmium accumulation by whole fish and fish livers was proportional to water Cd concentration. Mean whole fish and fish liver Cd concentrations across treatments ranged from 1.0-4.1 and 15.6-24.0 micro-g/g dry weight, respectively. Cadmium accumulation by fish was not affected by parasite burden. Cadmium concentrations in embryos were directly proportional to Cd content of whole fish, fish livers, and water. Parasite numbers were proportional to fish size and were not affected by Cd concentrations in water and fish, but mean parasite weight was inversely proportional to fish whole body Cd concentrations. No Cd- or parasite-induced effects on mortality or growth were observed. Mean recoverable liver weight was negatively related to both whole fish and liver Cd concentrations. (Rochester-IVI)
W86-00960

DRIFT RESPONSE OF AQUATIC INSECTS TO COPPER,
Geological Survey, Menlo Park, CA.
H. V. Leland.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2413-2419, 1985. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Aquatic drift, *Aquatic insects, *Copper, *Metals, *Water pollution effects, *Convict Creek, *California, Animal behavior, Mayflies, Caddisflies, Behavior, Species composition.

Different responses to continuous copper dosing were observed among drift insects in a section of the oligotrophic Convict Creek, California. Convict Creek, which has a pH in the range 7.9-8.5, and is always at or near saturation with dissolved oxygen, received copper continuously at rates of either 2.5, 7, 15 micro-g/l (approx 12, 35, and 75 nanogram/l Cu(2+)). Declines in population densities of common Ephemeroptera coincident with initial increases in drift density were evident in stream sections dosed with 7 and 15 micro-g/l total Cu. Population densities of many common aquatic Diptera (Antocha monticola, Hexatoma spp, Simulium spp, and Chironomidae) also declined at these doses, but drift densities of these taxa did not increase appreciably at these concentrations. Adults of the common Coleopterans Optioservus divergens and Cleptelmis addenda showed an increased propensity for drift at 15 micro-g/l total Cu, but neither species declined in the benthos, suggesting that Elmidae respond to sublethal copper concentrations by an increase in activity. Common insect taxa in the benthos and the drift were identified. Many were nocturnal, with the mayfly Baetis spp numerically dominant in the post-dusk drift. The caddisfly Brachycentrus americans was the only common drifting aquatic insect that was clearly more active during the day than at night. Drift densities of most of the common aquatic insects exhibited a consistent diel periodicity even in the presence of added copper. Drift densities were highest during periods when foraging normally occurred. (Rochester-IVI)
W86-00961

USE OF AQUATIC BRYOPHYTES TO MONITOR HEAVY METALS POLLUTION OF FRESHWATERS AS ILLUSTRATED BY CASE STUDIES,
Metz Univ. (France). Lab. d'Ecologie.
For primary bibliographic entry see Field 7B.
W86-00962

EFFECTS OF ACUTE PARATHION POLLUTION ON MACROINVERTEBRATES IN A STREAM,
Parma Univ. (Italy). Ist. di Ecologia.
P. F. Ghetti, and G. Gorbi.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2426-2431, 1985. 1 Fig, 3 Tab, 8 Ref.

Descriptors: *Parathion, *Insecticides, *Water pollution effects, *Macroinvertebrates, Aquatic drift, Species composition, Ecological effects, Toxicity.

Parathion, when added to an experimental stream in a manner simulating an accidental spill, produced rapid catastrophic mortality in stream insects; this impact was reflected in the rate and composition of drift, thus demonstrating that drift collections provide a way to reveal both the direct lethal effect and the successive recolonization and stabilization process of the community. An acute pollution event lasting 6 hr was produced by achieving a concentration of 1 + or - 0.18 mg/l parathion in a reach of stream in which drift in and out of the reach was monitored and substrates above and within the reach were sampled. The choice of concentration and duration was based on initial toxicity experiments which showed LC50s as follows: Brachidanio rerio (Pisces), 5.64 mg/l, Biomphalaria glabrata (Gastropoda), 8.09 mg/l; and Daphnia magna, 0.004 mg/l; and LT50s as follows: Echinogammarus stammeri, 92 min; Hydropsyche pellucidula, 110 min; and Baetis rhodani, 65 min. After the 6 hr dosing of the experimental stream, 100% of the Plecoptera, 78% of the Diptera, and 30% of the Trichoptera and Amphipoda had died on the first series of substrates, which were less than 100 m downsteam from where the parathion was introduced. By 24 hr after parathion release, 100% of the Diptera, 90% of the Amphipoda, 61% of the Trichoptera, 25% of the Isopoda, and 37% of the Coleoptera had died. At the substrates about 200 m below the release point, mortality continued after 24 hr, reaching 100% of the Trichoptera, Amphipoda, and Isopoda and 50% of the Coleoptera after 7 days. No mortality was observed in Mollusca and Oligochaeta species. Recolonization observed 30 days after the experiment resulted in a community of significantly different structure than the one present at the upstream station at the same time, suggesting a continuing, medium-term effect of pesticide release on the recolonization process. (Rochester-IVI)
W86-00963

USE OF LIMNOCORRALS FOR PESTICIDE TOXICITY STUDIES: EFFECT ON ZOOPLANKTON COMPOSITION AND DYNAMICS,
Tel-Aviv Univ. (Israel). Inst. for Nature Preservation Research.
For primary bibliographic entry see Field 5A.
W86-00964

EFFECTS OF 2,4-D ON NATURAL PHYTOPLANKTON SYSTEMS IN ASSOCIATION WITH MYRIOPHYLLUM SPICATUM,
National Water Research Inst., Burlington (Ontario).
B. F. Scott, N. D. Dickman, and P. Hayes.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2437-2446, March, 1985.

Descriptors: *Phytoplankton, *Myriophyllum, *Pesticides, *2,4-D, Herbicides, Organic compounds, Sediments, Macrophytes, Dissolved oxygen, Water pollution effects, Fate of pollutants, Food chains, Algae.

To investigate all aspects of an aquatic ecosystem and to follow the fate of added chemicals, as well as the breakdown products, a series of polyethylene-lined ponds were constructed. The linings of these ponds were covered with sediment and Myriophyllum spicatum plants were implanted in this sediment. Each major component of the food web was analyzed and interactions between the components were compiled. Specifically in this report, the chemistry of the 2,4-D and 2,4-DCP as well as the phytoplankton population fluctuations in association with the macrophyte, M. spicatum, for the 1981 tests is presented. The populations of dominant algal species in the treated ponds were corrected by subtracting the appropriate populations found in the control ponds. Species whose populations increased after treatment include Scenedesmus incrassatulus and Oscillatoria limnetica with other species having slight enhancements. Oocyctis eremosphaeria and Cosmarium cf. punctatum exhibited inhibition after treatment but soon recovered. By examining all components of the food web in lined-pond ecosystems, the fate and impact of suspected toxic substances can be determined under natural environmental conditions. (Baker-IVI)
W86-00965

STRUGGLE AGAINST ONCHOCERCIASIS IN THE VOLTA REGION: IMPACT OF INSECTICIDE TREATMENT ON THE NON-TARGET AQUATIC FAUNA (LA LUTTE CONTRE L'ONCHOCERCOSE DANS LA REGION DES VOLTA: IMPACT DES TRAITEMENTS INSECTICIDES SUR LA FAUNE AQUATIQUE NON-CIBLE),
Laboratoire d'Ichtyologie Generale et Appliquee, Paris (France).
D. Paugy.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, Part 4, p 2447-2451, March 1985. 10 Ref.

Descriptors: *Water pollution effects, *Insecticides, *Aquatic animals, *Africa, *Onchocerciasis, Vector control, Fish, Invertebrates, Fish food, Public health, Temephos, Chlorphoxime, Bacillus thuringiensis, Toxicity, Rivers.

Since 1974, a campaign to interrupt transmission of the parasitic disease onchoceriasis in 7 states in western Africa has included the regular application of biodegradable insecticides to eliminate the aquatic larval phase of the insect vector. The insecticides used were temephos, chlorphoxime and the biological insecticide Bacillus thuringiensis. Surveillance of the fish populations and aquatic invertebrates was carried out for 8 years to determine the effects of the insecticide treatment. The treatment of rivers has not brought about a perturbation in the fish populations. There was an effect on the lotic invertebrates, but it was at acceptable levels with all of the insecticides studied. As long as the fish do not suffer serious effects from the reduction in the numbers of invertebrate food species or the absence of some species, the human health concerns will outweigh the effects on the aquatic fauna. (Moore-IVI)
W86-00966

INFLUENCE OF PESTICIDES IN THE POLLUTION OF CONTINENTAL AFRICAN WATERS (INCIDENCE DES PESTICIDES DANS LA POLLUTION DES EAUX CONTINENTALES AFRICAINES),
Office de la Recherche Scientifique et Technique Outre-Mer, La Teste (France).
C. Dejoux.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, Part 4, p 2452-2456, March, 1985. 10 Ref.

Descriptors: *Pesticides, *Africa, *Water pollution effects, Agricultural chemicals, Vector control, Aquatic animals, Invertebrates, Water quality, Fish, Water pollution control.

The efforts to control major epidemic diseases in Africa necessitate the frequent introduction of pesticides into the aquatic environment or their use in the immediate area. The use of pesticides in agriculture is also very great. The effects of pesticides on the fauna of aquatic ecosystems in Africa was reviewed. Long-term, increasing effects including reduction in water quality and massive deaths of invertebrates can result from badly-used pesticides; this in turn can lead to the reduction of fish stocks. The same effect may result from pesticides which are directly toxic to fish. When pesticides are used on a large scale, whether temporal or spatial, strict control is necessary. In spatially broad pesticide programs, a permanent collaboration between users and environmental scientists may be necessary to forsee the impact. Monitoring is essential in such circumstances. (Moore-IVI)
W86-00967

MODEL FOR FORECASTING ACUTE TOXICITY OF RIVER WATER FOR FISH (MODELE DE PREVISION DE LA TOXICITE AIGUE DES EAUX DE RIVIERES POUR LE POISSON),
Metz Univ. (France). Faculte des Sciences.
J. C. Pihan, and G. Landragin.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2457-2462, 1985. 11 Fig, 1 Tab, 7 Ref.

Descriptors: *Model studies, *Toxicity, *Fish, *Forecasting, Ammonia, Nitrates, Cyanide, Phenols, Heavy metals, Detergents, Potassium, Sodium.

A 'concentration and addition type' model uses the CL50-48h proportions addition method, in order to assess a global index of toxicity. This model takes into account the following parameters: NH4, NO2, CN, phenols, Zn, Cu, Pb, Cd, Ni, K, Na, anionic detergents, As, Se, Cr, Mn, calculated in water. It calculates the CL50-48h of these toxicants according to environmental parameters in each sample. A statistical and graphic interpretation of the results enables one to give a qualitative and quantitative judgment of the toxicity level of a river, and the safety measures to observe. This model also allows one to test a future scenario for the river. (Author's abstract)
W86-00968

ACCUMULATION OF RADIUM-226 BY POPULATIONS OF THE FRESHWATER MUSSEL, VELESUNIO ANGASI, FROM THE ALLIGATOR RIVERS URANIUM PROVINCE, NORTHERN TERRITORY, AUSTRALIA,
Australian Atomic Energy Commission Research Establishment, Sutherland.
R. A. Jeffree.
Verhandlung Internationale Vereinigung Limnologie, Vol. 2, No. 4, p 2486-2492, March, 1985. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Radium radioisotopes, *Mussels, *Alligator Rivers Uranium Province, *Northern Territory, Australia, Billabongs, Calcium, Magnesium, Uranium mines.

The radionuclide Ra-226 naturally leaches from uranium deposits in the Alligator Rivers Uranium Province, Northern Territory. Mussels sampled from Corndorl, Georgetown and Mudginberri Billabongs individually vary over an order of magnitude in their Ra-226 tissue concentration. Because of this variability, large actual increases in the tissue concentration of Ra-226 above these levels would have to occur before a statistically significant increase could be demonstrated. The predictive relationships established between Ra-226 concentration and size measurements, and Ca and Mg concentration can be used to reduce this variance. For each billabong, these regression equations can be used to account for between 83 and 97% of the variance in Ra-226 concentration. For mussels from the three billabongs, the significant predictors of Ra-226 concentration show similar relationships. The concentration of Mg, in combination with size measurements, is a significant predictor of Ra-226 in mussels from Georgetown and Mudginberri billabongs. Because predictive relationships can be population specific, they would need to be separately determined for each billabong from which mussels were harvested for human consumption, and which could potentially receive uranium mine effluent or were to be used as a control sampling site. The pattern of accumulation of Ra-226 indicates that V. angasi does not regulate its concentration of Ra-226, but continues to accumulate Ra-226, and also Ca, as it increases in size. The accumulated Ra-226 is located predominantly together with Ca and Mg in granular deposits that are dispersed throughout the tissues, and that increase in abundance with increasing mussel size. (Baker-IVI)
W86-00972

EFFECTS OF POWER PLANT ENTRAINMENT ON PHYTOPLANKTON RESPONSE,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
W. Y. B. Chang, and R. Rossmann.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2493-2497, March, 1985. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Phytoplankton, *Powerplants, *Entrainment, *Thermal pollution, Water pollution effects, Chlorophyll, Phaeophytin, Primary productivity, Cooling water, Heated water, Corrosion.

The effect of entrainment on phytoplankton has been investigated using chlorophyll and cell counting techniques alone from 1975 to 1979 and in conjunction with C-14 uptake methods since 1979. Chlorophyll and phaeophytin concentrations as well as cell counts do not significantly change in water which has passed through the co
cooling system; productivity is reduced sig
ly (20-80%). Between 1980 and 1982, the r
ship of this reduction to temperature, hy
chanics, and availability of micronutrients
vestigated. Elevated temperature expe
showed that the rate of reduction in prima
ductivity was greatest in those samples st
to heat above 35 degrees C. For the sample
to or above 50 C, the primary productivity
hours of incubation was less than 0.5 mg/c
was at times close to zero. The productivi
ples from the intake water which had bee
to the temperature of the discharge wa
productivities as high as those of intake
This suggests that although water is wel
after going through the condenser cooling
the water passing through the condenser i
ceives a differential heat, such that a portio
lake water was heated above the toleran
for phytoplankton. Fragments of phytop
did not increase significantly after the wate
through the system, and pigment conce
showed no significant difference before a
passage through the condenser cooling
Differential temperature effects on the wat
ing through the cooling system is a source
reduction in primary productivity at the pa
power plant, but EDTA experiments lead
conclusion that the presence of microelem
also be a factor in producing this change. T
effects of corrosion of plant components ca
excluded entirely from the assessment. (Bak
W86-00973

**MUTAGENICITY AND ORGANIC HA
DETERMINATION IN BODY FLUIDS
TISSUES OF RATS TREATED WITH
ING WATER AND PULP MILL BLEA
EFFLUENT CONCENTRATES,**
Sentralinstitutt for Industriell Forskning
(Norway).
S. Monarca, J. K. Hongslo, A. Kringstad, a
E. Carlberg.
Chemosphere, Vol. 13, No. 12, p 1271-128
5 Tab, 31 Ref.

Descriptors: *Halogenated hydrocarbons,
gens, *Drinking water, *Bleaching waste
wastes, Chlorination, Toxicity, Water pollu
fects, Bioassay,.

The use of chlorine for drinking water disi
and as a bleaching agent in the pulp an
industry produces mutagenic compounds i
ing water and spent bleach liquors. Urine
liver and adipose tissues of rats after tr
with single doses of concentrates of either
ing water or pulp mill effluent were tes
mutagenic activity using the microscale fluc
assay, a sensitive bacterial mutagenicity tes
lar organic halogen doses were admin
Urine, feces, liver, and adipose tissues we
analyzed for organic halogen. For both
types nearly all the organic halogen taken u
from the chlorination stage sample and 4
the drinking water sample) was excreted
urine during the first day. The difference in
of organic halogen between the two samp
probably be explained by difference in s
polarity distribution of the halogenated
pounds. Weak mutagenic activity could be
in the urine collected the first day from
treated with the highest dose of drinking
No mutagenic activity was detected in th
from animals treated with the pulp mill
trates, or in the feces or tissue extracts fr
two treatment groups. (Moore-IVI)
W86-00993

**FATE AND EFFECTS OF PENTACH
PHENOL IN HARD- AND SOFT-WATE
CROCOSMS,**
Environmental Research Lab., Athens, GA
For primary bibliographic entry see Field 5E
W86-00998

**'MAN AND THE BIOSPHERE' - STUDI
SIKKIM HIMALAYAS. PART 1: ACUTE
ICITY OF COPPER AND ZINC TO CO**

PRINUS CARPIO (LINN.) IN SOFT

v. (India). Dept. of Anthropology.
garot, A. Sehgal, and M. K. Bhasin.
rochimica et Hydrobiologica, Vol. 11, 667-673, 1983. 1 Fig, 4 Tab, 21 Ref.

s: *Carp, *Toxicity, *Copper, *Zinc, Mortality, Heavy metals, Fish.

s of Cu and Zn on the common carp carpio) were studied in soft water (7.1 +) and 0.7 mg/l Mg(2+)) at water es of 11 to 14 C. The survival rate of sed as the concentration of Cu and Zn Most of the mortality appeared in the f exposure. No mortality was observed osed to Zn or Cu concentrations of 0.1 005 ppm, respectively. The 96-hr LC50 s carpio was observed to be 0.063 mg/l l 3.12 mg/l Zn(2+). Significant differ- ortality in relation to the 12-hr LC50 pper only after 72 hr of exposure and r 48 hr of exposure. The values of 96- clearly lower for both metals in these s than most values given in the litera- r fish species. (Moore-IVI)

UCED LESIONS IN THE GILLS OF DANICONIUS NEILGERIENSIS N),

(India). Dept. of Anthropology.
rot.
chimica et Hydrobiologica, Vol. 11, 682, 1983. 7 Ref.

*Zinc, *Fish, *Gills, *Water pollution city, Heavy metals, Histology.

anges in the gills of a freshwater ora daniconius neilgeriensis following inc were examined. The most notable ed gill damage was the detachment of er of secondary lamellae and necrosis al sheet. Histological changes suggest a direct effect on the branchial appa- nay result in a gradual decline of the ing capacity and hence cause anoxia n respiratory failure. This increasing ay also have deterimental effects on e tissues such as the central nervous he cardiac and muscular systems.

ALITY CONTROL IN IMPOUND-

ieny a Epidemiologie, Prague ia).
bibliographic entry see Field 5G.

OF ZINC AND LEAD COM- WATER ON THE ASSIMILATION LIS ANTIPYRETICA (ZUM EIN- RUCKSTANDEN VON ZINK- UND DUNGEN IM WASSER AUF DIE ON VON FONTINALIS ANTIPYR-

iv., Dresden (German D.R.). Sek- sen.
urger, S. Fuchs, and L. Schurmann.
imica et Hydrobiologica, Vol. 13, 1985. 5 Fig, 20 Ref.

Lead, *Zinc, *Fontinalis, *Carbon c plants, Heavy metals, Phytotoxi- hesis, Light effects, Plant physiolo- tion effects.

xide assimilation of Fontinalis anti- ibited by 100 mg/l Zn(2+) or t a lethal effect being caused. With of exposure from one to six days alue of toxicity is lowered and at e net assimilation is reduced within oncentration of 0.1 mg/l. In the num of the environmental condi- y is weaker than under other unfa- vorable environmental conditions at the same time. Therefore, the photoecologically optimum illumination of 1200 lx is an effective bioprotector against phytotoxic lead ion concentrations, so that at 1200 lx also at a comparatively high load a positive photosynthesis balance can be maintained. In the dark, in the first hour after the application of the lead ions dissimilation is a function of concentration, subsequently the respiration differences decrease very much in the range between 0 and 100 mg/l lead(II)-ions. Stimulating effects could be demonstrated only by 0.01 mg/l Pb(2+) and only for the carbon dioxide assimilation. (Author's abstract)
W86-01008

ACUTE TOXICITY OF DISTILLERY EFFLUENT ON A FRESHWATER FISH AND THREE POND SNAILS,
Udaipur Univ. (India). Dept. of Limnology and Fisheries.
B. S. Khangarot, P. S. Rao, S. S. Shekhawat, and V. S. Durve.
Acta Hydrochimica et Hydrobiologica, Vol. 13, No. 1, p 53-58, 1985. 3 Tab, 21 Ref.

Descriptors: *Toxicity, *Fish, *Snails, *Distillery wastes, Industrial wastewater, Effluents, Water pollution effects, Bioassay, Sulfides, Suspended solids.

The LC50 for 12-96 h of a distillery wastewater were determined for Lebistes reticulatus, Lymnaea luteola, Lymnaea acuminata and Viviparus bengalensis in the batch experiment with daily exchange of the medium. The sensitivity of the species increases in the given sequence with values of the LC50,96h of 10.77 to 3.73% proportion of wastewater in the medium. Compared with this, with values of the LC50,48h of 14.06-15.71% after 48 h of exposure there is no significant difference in sensitivity, whereas after exposure for 12 and 24 h the sensitivity grows in the following order: V. bengalensis, L. acuminata, L. luteola, Lebistes reticulatus. Toxicity is obviously primarily determined by the sulfides; with increasing time of exposure also the suspended matter and other factors act toxically. (Author's abstract)
W86-01011

ABSENCE OF SELENATE AVOIDANCE BY FATHEAD MINNOWS (PIMEPHALES PROMELAS),
North Texas State Univ., Denton. Dept. of Biological Sciences.
D. E. Watenpaugh, and T. L. Beitinger.
Water Research, Vol. 19, No. 7, p 923-926, 1985. 1 Fig, 2 Tab, 30 Ref.

Descriptors: *Selenates, *Fathead minnows, *Avoidance, Fish behavior, Selenium, Water pollution effects.

Forty fathead minnows (Pimephales promelas) were individually offered a choice between 'clean' water and water containing selenate in a flow-through, Sprague-type avoidance system. During a control period beginning each trial, fatheads exhibited no significant avoidance of either end of the test chamber. Mean residence times in the two ends equalled 48.8 and 51.2% of total time. Similarly fathead minnows did not avoid selenate at concentrations of 0.3-11.2 mg Se/l in 4 separate trials. Overall, the 40 fish partitioned 48.5 and 51.5% of their time in the selenate and selenate-free ends respectively. These results demonstrate that fathead minnows do not behaviorally avoid harmful concentrations of selenate. (Author's abstract)
W86-01067

SOME OBSERVATIONS ON THE OXYGEN CHANGES IN A LAKE COVERED WITH PISTIA STRATIOTES L.,
Ibadan Univ. (Nigeria). Dept. of Preventive and Social Medicine.
M. K. C. Sridhar, and B. M. Sharma.
Water Research, Vol. 19, No. 7, p 935-939, 1985. 1 Fig, 7 Tab, 19 Ref.

Descriptors: *Water lettuce, *Dissolved oxygen, *Lakes, Eutrophication, Nutrients, Water pollution effects, Hydrogen ion concentration, Aquatic plants, Decomposition.

Water lettuce (Pistia stratiotes) is a common free floating aquatic weed in most of the water bodies in Nigeria. In Oba, the lake under study, this weed at one time covered the whole surface. A bamboo barrier was put across the lake and the weed was removed manually from one zone. The lake is fed by two major streams, one of which is polluted and rich in nutrients. A study was made on the dissolved oxygen levels and pH changes in the lake. The lake generally showed low levels of dissolved oxygen and low pH values. These could be attributed to the incoming organically rich water, coverage of the surface by Pistia plants and to the decomposition of these plants resulting in the formation of sludge at the bottom of the lake. Only on one occasion during rainy season did the dissolved oxygen exceed the natural saturation level. That was probably as a result of algae being washed in. (Moore-IVI)
W86-01068

ASSESSMENT OF ECOLOGICAL CHANGES DURING THE RECENT HISTORY OF LAKE ONTARIO BASED ON SILICEOUS ALGAL MICROFOSSILS PRESERVED IN THE SEDIMENTS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 2H.
W86-01110

RESPONSES OF BENTHIC MEIOFAUNA TO LONG-TERM, LOW-LEVEL ADDITIONS OF NO. 2 FUEL OIL,
Rhode Island Univ., Narragansett. Graduate School of Oceanography.
J. B. Frithsen, R. Elmgren, and D. T. Rudnick.
Marine Ecology - Progress Series, Vol. 23, No. 1, p 1-14, 1985. 5 Fig, 3 Tab, 99 Ref.

Descriptors: *Hydrocarbons, *Fuel oil, *Water pollution effects, Ecological effects, Sediments, Fate of pollutants, Benthos.

Three experiments were conducted to investigate the responses of benthic meiofauna to long-term, low-level additions of No. 2 fuel oil in large (13 cu m), outdoor tanks (mesocosms) containing sediment and sea water from Narragansett Bay, Rhode Island. In the first experiment, an average water column oil concentration of 190 ppb was maintained for 168 d followed by a 64 d period of no oil additions. During the second experiment, an average oil concentration of 90 ppb was maintained for 122 d. A 386 d period of no oil additions (Experiment III) followed Experiment II. The abundances of metazoan meiofauna decreased during oil addition periods in Experiments I and II with the oil more extensively affecting the meiofauna in the first experiment. In both experiments, ostracods and harpacticoid copepods were the most sensitive metazoan groups. In contrast, abundances of protozoan meiofauna (foraminiferans and ciliates) were higher in the oiled mesocosms. Abundances of most meiofaunal groups returned to levels similar to the controls within 2 to 7 mo following the termination of oil additions. However, the abundances of kinorhynchs and halacarids remained depressed for more than 1 yr after the last oil addition, presumably due to residual oil in the sediments. (Author's abstract)
W86-01124

QUALITATIVE ANALYSIS OF THE PELAGIC FOODWEBS OF THREE ACID-IMPACTED LAKES IN NOVA SCOTIA, CANADA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W86-01129

EFFECTS OF ENTRAINMENT ON PHYTOPLANKTON PRIMARY PRODUCTION AT FOUR THERMAL ELECTRIC GENERATING

STATIONS ON THE LAURENTIAN GREAT LAKES,
Ontario Hydro, Toronto. Research Div.
T. G. Dunstall.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 2, p 247-257, 1985. 3 Fig, 3 Tab, 31 Ref.

Descriptors: *Environmental effects, *Electric power production, *Great lakes, *Phytoplankton, *Entrainment, *Laurentian Great Lakes, Cooling water, Primary production, Water temperature, Water pollution effects, Thermal pollution.

Primary production was used to measure the response of phytoplankton to entrainment in once-through cooling water at thermal electric generating stations. Ambient lakewater temperatures ranged from 1.0 to 20.5 C. The maximum discharge temperature was 32.0 C. There was no chlorination of cooling water at the stations studied. On a few occasions, primary production was stimulated following station passage by discharge temperatures which were approximately 10 C above ambient lakewater temperatures of 4.5 to 8.5 C. Differences in production levels were not apparent, however, following the return of discharge water to ambient lakewater temperature. There was no consistent response of phytoplankton to the temperature regimes tested, with production levels generally differing by less than 20% as a result of station passage or temperature elevation alone. Entrainment was considered to have minimal impact on phytoplankton productivity in large open water bodies such as the Great Lakes. (Author's abstract)
W86-01132

EFFECTS OF BENTHIOCARB HERBICIDE ON GROWTH OF PLANKTONIC ORGANISMS, CHLORELLA SACCHAROPHILA AND BRACHIONUS PLICATILIS,
Kagoshima Univ. (Japan). Faculty of Fisheries.
H. Hirata, S. Yamasaki, and E. Kohirata.
Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 33, No. 1, p 51-56, December, 1984. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Herbicides, *Benthiocarb, *Toxicity, *Growth, *Chlorella, *Brachionus, Water pollution effects, Ethanol, Pesticides, Zooplankton, Phytoplankton.

The effects of benthiocarb herbicide on the population growth of planktonic organisms were examined to evaluate its toxicity in natural rivers as runoff from rice fields. The organisms used in this experiment were Chlorella saccharophila and Brachionus plicatilis. Concentrations of the herbicide were regulated to sub-acute levels at: 0.0 ppm as control, 0.0003 ppm, 0.01 ppm, 0.03 ppm, 0.1 ppm, and 0.3 ppm. Ethanol was used to dilute the original concentrated benthiocarb. The effects of ethanol on the growth of plankton were also observed. There were no significant differences found among the culture experiments conducted for the growth of C. saccharophila and B. plicatilis below the herbicide concentration of 0.3 ppm. However, in the ethanol experiments, the growth rate of plankton was less than that at a 0.3 ppm herbicide concentration. Careful utilization of ethanol for dilution is suggested for practical use. (Author's abstract)
W86-01146

TOXICITY CURVE ESTIMATION: FITTING A COMPARTMENT MODEL TO MEDIAN SURVIVAL TIMES,
Ortho Pharmaceutical Corp., Raritan, NJ. Dept. of Medical Biostatistics.
R. D. Chew, and M. A. Hamilton.
Transactions of the American Fisheries Society, Vol. 114, No. 3, p 403-412, May, 1985. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Toxicity curves, *Compartment models, *Toxicology, *Median survival times, Mathematical analysis, Statistical analysis, Data interpretation.

In an acute lethality toxicity test, organisms are continuously exposed to each of several concentrations of the toxicant and subsequent deaths are recorded. The results of the test are often summarized by the toxicity curve, which shows for each concentration the exposure time required to cause exactly 50% mortality. A new statistical procedure for estimating the toxicity curve was developed; it is based on a mathematical model derived from plausible assumptions about the biological mechanisms of acute toxicity. The statistical fit of the model is accomplished by nonlinear, weighted, least-squares regression, estimated median survival times being responses and concentration being the independent variable. The usual methods for constructing a toxicity curve are encumbered by at least one of two weaknesses: either the mathematical form of the curve has no apparent biological justification or the statistical fit of the curve treats concentration as the response and time as the independent variable, thereby reversing the cause-effect relationship. The new method possesses neither of these deficiencies. Analyses of two toxicity tests indicate that the proposed mathematical model is not inconsistent with real data. (Author's abstract)
W86-01152

EFFECTS OF SUBLETHAL COPPER CONCENTRATIONS ON THE STRUCTURE AND ACTIVITY OF ATLANTIC SILVERSIDE SCHOOLS,
Rhode Island Univ., Narragansett. Graduate School of Oceanography.
K. H. Koltes.
Transactions of the American Fisheries Society, Vol. 114, No. 3, p 413-422, May, 1985. 8 Fig, 2 Tab, 46 Ref.

Descriptors: *Copper, *Toxicity, *Water pollution effects, *Silverside, *Fish behavior, Behavior, Metals, Animal behavior.

The effects of sublethal concentrations of copper on the structure and activity of schools of the Atlantic silverside, Menidia menidia, were studied. A computerized video technique was employed to provide three-dimensional analysis. Ten experiments were conducted in which the behavior of a school exposed to from 0 to approximately 100 micro-g/L of copper was compared to the behavior of the same school on the previous day (control). Fish schools exposed to copper differed significantly ($P < 0.05$) from control schools in distance to nearest neighbor, swimming speed, mean direction of travel, rate of change of direction, and depth of the school in the tank. At low concentrations of copper, schools increased their swimming speed, decreased their rate of change of direction and their nearest-neighbor distances, and swam more in parallel orientation than schools under control conditions. (Author's abstract)
W86-01153

PLASMA OSMOTIC AND ELECTROLYTE CONCENTRATIONS OF LARGEMOUTH BASS FROM SOME ACIDIC FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Fisheries and Aquaculture.
D. E. Canfield, Jr., M. J. Maceina, F. G. Nordlie, and J. V. Shireman.
Transactions of the American Fisheries Society, Vol. 114, No. 3, p 423-429, May, 1985. 3 Tab, 29 Ref.

Descriptors: *Fish physiology, *Bass, *Hydrogen ion concentration, *Florida, Acidity, Acid lakes, Growth, Water pollution effects.

Five acidic clear (pH 3.7-4.9), three acidic colored (pH 4.1-4.6), and three neutral (pH 6.9-7.3) north-central Florida lakes were surveyed in 1983 to determine plasma osmotic and electrolyte concentrations, growth, and coefficients of condition for largemouth bass, Micropterus salmoides floridanus. Plasma osmotic concentrations averaged greater than 273 milli-osmoles/kg in fish from acidic colored and circumneutral lakes, but averaged less than 269 milli-osmoles/kg in four of the acidic clear lakes. Growth and coefficients of condition of largemouth bass > 305 mm total length in the acidic lakes were significantly lower than in the neutral lakes. Reduction in fish growth and condition, however, could be related to either conditions or lake trophic status. (Auth
stract)
W86-01154

CHANGES IN THE PLEUSTIC MACRO
FLORA OF 54 SMALL FINNISH LAKE
YEARS,
Helsinki Univ. (Finland). Dept. of Botany.
For primary bibliographic entry see Field
W86-01156

GROWTH AND FEEDING BEHAVIO
SPONSES OF LARGEMOUTH BASS (M
TERUS SALMOIDES) EXPOSED TO PC
Queen's Univ., Kingston (Ontario). Dept.
ogy.
R. A. Mathers, J. A. Brown, and P. H. Joh
Aquatic Toxicology, Vol. 6, No. 3, p
May, 1985. 2 Tab, 16 Ref.

Descriptors: *Bass, *Growth, *Fish phy
*Fish behavior, *Pentachlorophenol, Wat
tion effects, Chlorinated hydrocarbons, A
havior, Toxicity.

Previous experiments have shown that ch
posure to PCP results in a reduction
growth. The effects of PCP on growth
have not been examined for any of the Ce
family which includes the largemouth b
cropterus salmoides). The growth and fee
havior of individually held underyearlin
mouth bass exposed to 50 micro-g/l pen
phenol (PCP) was monitored over a 7-da
which followed a 7-day acclimation perio
experimental conditions. Exposure to PCP
food conversion efficiency (g of growth/g
by 30% as well as the amount of food co
Feeding efficiency (capture to strike ratio)
lowered by PCP exposure. No PCP coul
tected in the fish not exposed to PCP. O
exposed to PCP there was no significant d
between the concentrations found in
ration fish (mean = 10.8 micro-g PCP/g
1.4, n = 4) and the low ration fish (mea
micro-g/g, SD = 4.7, n = 5). PCP not on
physiological stress on fish but it also
changes in feeding behavior. The experi
only documents growth related respon
toxic substance but demonstrates that the
a toxic substance can be readily determine
carefully executed short term experiment.
IVI)
W86-01157

CYTOTOXICITY/GENOTOXICITY: T
PLICATION OF CELL CULTURE
NIQUES TO THE MEASUREME
MARINE SEDIMENT POLLUTION,
Washington Univ., Seattle. Coll. of Fo
sources.
R. M. Kocan, K. M. Sabo, and M. L. Land
Aquatic Toxicology, Vol. 6, No. 3, p
May, 1985. 4 Fig, 2 Tab, 39 Ref.

Descriptors: *Toxicity, *Bioassay, *Cyto
*Genotoxicity, *Cell cultures, *Marine se
*Puget Sound, *Washington, Water poll
fects, Fish physiology, Sediments, Halogen
drocarbons, Benzo(a)pyrene, Nitrosamide
chlorinated biphenyls, Heavy metals.

Fish cell cultures were used to determine
in vitro aquatic animal cell culture syste
capable of detecting pollution in the mar
ronment. Cells derived from rainbow tro
(RTG-2) and bluegill fry tissues (BF-2) w
as model cell systems to measure cytotoxi
genotoxicity following exposure to Puge
sediment extracts, benzo(a)pyrene and M
nitrosamide). Sediment was collected from
sites within Puget Sound known to be co
ed with compounds such as polycyclic
hydrocarbons, polychlorinated biphenyls,
ated hydrocarbons and heavy metals. Eac
sediment samples was extracted with orga
vents and added to cultures of the two m
systems in DMSO. Following exposure
tures were evaluated for cell death, mitoti

ılatory effects, and chromosomal ese cell cultures responded to the sedi- ts much as they did to known mutagen- enic chemicals which were used as ounds. Those sediments known to be d, based on chemical analysis and his- atterns were also found to be qualita- quantitatively more toxic than were om areas which were relatively unaf- man activity. The results show that in stems are capable of detecting pollu- arine environment and have the poten- powerful tools in aquatic toxicology in with whole animals or as a method of aterials prior to in vivo testing. (Au- ct)

BIOTRANSFORMATION, AND ON OF ROTENONE BY BLUE- OMIS MACROCHIRUS),
nery Research Lab., La Crosse, WI. rich, and J. J. Rach.
icology, Vol. 6, No. 3, p 179-196, Fig, 3 Tab, 28 Ref.

*Fate of pollutants, *Bluegill, *Fish Bioconcentration, *Rotenone, *Insec- ransformation, Pesticides, Water pol- Animal tissues, Fish tissues, Animal letabolism.

gills (Lepomis macrochirus) were ex- thal concentrations of C-14 rotenone) for 30 days in a continuous flow em and then transferred to clean, for an additional 21-day depuration of uptake and elimination and profile d metabolites in head, viscera, and nents were evaluated by C-14 count- gh performance liquid chromatogra- -14 rotenone derived activity was orm in all body components within 3 al exposure and remained constant suing 27 days of exposure. Initial efficients were highest in viscera (K and were nearly identical for head /h) and carcass (K sub u = 10/h). ssue extracts by high performance ography confirmed the presence of ransformation products of rotenone. % of the activity extracted from esent as a single peak which repre- ound that was extremely soluble in ue composed only 0.3% of the ex- ty in viscera taken from fish ex- one for 30 days; however, rotenone 5.4% of extractable activity in the in the carcass components. Roten- '-dihydro-6,7'-dihydroxyrotenolone identified as oxidation products in cts. Elimination of C-14 activity components was biphasic; both first-order kinetics. The rate of nearly equal for all body compo- e initial phase but was most rapid ring the second phase of elimina- tration factors for the head, vis- s were 165, 3,550, and 125, respec- culated on the basis of total C-14 25.4, 11, and 26 when calculated ation of parent material. (Author's

E STRUCTURE ACTIVITY RE- AND MIXTURE TOXICITY ALCOHOLS AND CHLOROHY- : EFFECTS ON GROWTH OF GNA,
iversiteit (Netherlands). Dept. of nacology, Pharmacy and Toxicol-

roekhuyzen, H. Canton, and R.

ogy, Vol. 6, No. 3, p 209-217, 6 Tab, 14 Ref.

Toxicity, *Synergistic effects, yth, *Alchohols, *Chlorinated hy- ructure activity relationships, *Mixtures, Water pollution effects, Chlorobenzenes, Mixture toxicity index, No observable effects concentration, Crustaceans.

The joint effects of mixtures of several similarly acting compounds were assayed in acute and subacute toxicity experiments with several aquatic species. The classification of the several groups was based on quantitative structure-activity relationships (QSARs). A close realtionship indicates a similarity of mode of action for the chemicals within the group studied. Effects on growth of Daphnia magna were studied for 10 non-reactive organic chemicals such as alcohols and chlorobenzenes. The 'no observed effect concentration' (NOEC) was very well correlated with the hydrophobicity (P sub oct) of the tested compounds which appeared in a QSAR study. With this QSAR the NOEC for 15 other compounds was predicted. The joint toxicity of mixtures of 10 and 25 compounds was also tested. The standard deviation in the Mixture Toxicity Index (MTI) was calculated with an estimated standard deviation in log NOEC of 0.10. The NOEC of these mixtures was predictable on the basis of concentration-additivity. It is likely that the small deviations from concentration-additivity are not systematic for mixtures of chemicals with the same modes of action, but are due to a lower reproducibility of experiments with sublethal toxicity criteria such as inhibition of reproduction or growth. Joint levels of mixtures of chemicals with similar modes of action, as indicated by QSAR studies, are concentration-additive. At levels such as NOECs with sublethal toxicity criteria joint toxicity is still present. (Collier-IVI)
W86-01160

ECOTOXICOLOGICAL ASPECTS OF PULP AND PAPER MILL EFFLUENTS DISCHARGED TO AN INLAND WATER SYSTEM: DISTRIBUTION IN WATER, AND TOXICANT RESIDUES AND PHYSIOLOGICAL EFFECTS IN CAGED FISH (SALMO GAIRDNERI),
Helsinki Univ. (Finland). Dept. of Zoology.
A. Oikari, B. Holmbom, E. Anas, M. Miilunpalo, and G. Kruzynski.
Aquatic Toxicology, Vol. 6, No. 3, p 219-239, May, 1985. 3 Fig, 9 Tab, 36 Ref.

Descriptors: *Ecological effects, *Toxicity, *Pulp and paper industry, *Industrial wastewater, *Bleaching wastes, *Phenolics, *Resin acids, *Trout, *Fish physiology, *Path of pollutants, Bioaccumulation, Blood, Animal tissues, Fish tissues, Animal physiology.

Simultaneous studies were conducted on concentrations of chlorinated phenolics (CP) and resin acids (RA) in bleached kraft pulp mill effluents (BKME), their distribution in the receiving water, their uptake and accumulation in the blood plasma of rainbow trout caged in the recipient, as well as short-term physiological effects developed in fish. RA disappeared from the lake water much faster than most of the CP. Some of the BKME-related substances (e.g. 2,4,6-trichlorophenol, 4,5,6-trichloroguaiacol, tetrachloroguaiacol and dehydroabietic acid) were also detected upstream from the mill, thus implying a low-level contamination of this water system in general. In the blood plasma of caged trout free RA were detected up to 3 km from the sewer, but free CP were analyzed as far as 11 km from the mill. During the 10-day caging period a partial inhibition of liver UDP-glucuronosyltransferase was observed even at 11 km from the BKME source. Brain acetylcholinesterase activity showed that BKME did not work like anticholinesterase agents, whereas a decrease of plasma cholinesterase activity was developed in a few days in the nearest 6 km from the sewer. Trout exposed at 6-11 km from the sewer displayed increased blood hemoglobin and decreased plasma protein concentrations. The plasma ionic picture (Na, Cl, Mg) indicated only negligible effects on fish osmoregulation. (Author's abstract)
W86-01161

FACTOR INTERACTION INFLUENCING THE DISTRIBUTION OF THE FRESHWATER 'SHRIMP' GAMMARUS,
Oslo Univ. (Norway). Biologisk Inst.
For primary bibliographic entry see Field 2H.
W86-01162

ENHANCEMENT OF MARINE PRIMARY PRODUCTION BY NITROGEN-ENRICHED ACID RAIN,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
H. W. Paerl.
Nature, Vol. 315, No. 6022, p 747-749, 27 June 1985. 3 Fig, 7 Ref.

Descriptors: *Primary production, *Marine environment, *Nitrogen, *Acid Rain, Rain, Nutrients, Water pollution effects, Hydrogen ion concentration, Phytoplankton, Growth.

The effect of acid rain on the pH of freshwater habitats is well known. The acidity of rainwater is largely due to hydrated oxides of sulfur, nitrogen and carbon, which also constitute nutrients essential for plant growth. Most freshwater and marine environments contain sufficient quantities of inorganic carbon and sulfur to satisfy plant growth needs, but nitrogen inputs can at times fall short of growth demands. Nitrogen limitation of phytoplankton growth is widespread and chronic in some marine waters. Nitrogen-limited conditions in North Carolina near-surface waters are ameliorated following rainfall inputs; the most acidic rainfall events led to the greatest stimulation of phytoplankton growth. Continentally-derived acid rain consistently contained more inorganic nitrogen (NO_3^-, NO_2^- and NH_4^+) than near neutral rainfall generated from oceanic fronts. Marine primary production can thus be influenced by the source of rainfall in marginal environments. (Author's abstract)
W86-01172

EPIDEMIOLOGICAL EVIDENCE FOR HELMINTH AND CHOLERA TRANSMISSION BY VEGETABLES IRRIGATED WITH WASTEWATER: JERUSALEM - A CASE STUDY,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
For primary bibliographic entry see Field 5D.
W86-01173

OCCURRENCE OF VIRUSES IN TREATED DRINKING WATER IN THE UNITED STATES,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W86-01193

PHOSPHORUS, NITROGEN AND CHLOROPHYLL-A CONCENTRATIONS IN A TYPICAL DUTCH POLDER LAKE, TJEUKEMEER, IN RELATION TO ITS WATER REGIME BETWEEN 1968 AND 1982,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
For primary bibliographic entry see Field 2H.
W86-01196

ROLE OF PHYTOPLANKTON IN THE DISSOLVED OXYGEN BUDGET OF A STRATIFIED ESTUARY,
Southern Water Authority, Otterbourne (England). Resources Planning Lab.
For primary bibliographic entry see Field 2L.
W86-01197

MODELLING OF OXYGEN DEPLETION IN COASTAL WATERS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
A. Malmgren-Hansen, P. Mortensen, and B. Moller.
Water Science and Technology, Vol. 17, No. 6/7, p 967-978, 1985. 12 Fig, 1 Tab, 5 Ref.

Descriptors: *Oxygen depletion, *Coastal waters, *Model studies, *Thisted Bredning, *Denmark, Nutrients, Wind, Mixing, Eutrophication, Wastewater pollution, Hydrography, Weather.

The relative importance of nutrient loadings and hydrographical and meteorological conditions for oxygen conditions in the Thisted Bredning, Denmark were evaluated by intensive survey and model calculations. The influence of wind speed on the vertical mixing in the unstratified shallow waters was quantified and tested in an oxygen model. The significance of oxygen consuming biological processes on the oxygen conditions were tested. By the use of a eutrophication model, the influence of local discharges of sewage on the size of the oxygen producing and oxygen consuming processes in the Thisted Bredning was calculated. Calculations showed that only a minor increase in rates of the oxygen consuming processes result in a drastic rise in the probability of oxygen depletion. (Author's abstract)
W86-01235

CONTRIBUTION OF AGRICULTURAL LOADING TO EUTROPHICATION IN FINNISH LAKES,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5B.
W86-01247

BIOSPHERE LEVELS OF CADMIUM, ZINC AND COPPER AROUND AN OLD SWEDISH COPPER MINE,
Linkoeping Univ. (Sweden). Dept. of Pharmacology.
C. E. Lundholm, and L. Andersson.
Ambio, Vol. 14, No. 3, p 167-172, 1985. 6 Fig, 3 Tab, 19 Ref.

Descriptors: *Water pollution sources, *Cadmium, *Zinc, *Copper, *Sweden, *Bersbo, *Mine wastes, *Metals, Heavy metals, Reeds, Rush, Crayfish, Roots, Fens, Wetlands, Animal tissues, Water pollution effects, Fate of pollutants.

The effects of heavy metals leaching from waste tips at an old copper mine in Bersbo, Sweden, on the levels of cadmium, zinc and copper in the biosphere were investigated in light of plans to drain and cultivate a nearby fenny area which is periodically flooded by runoff water from the tips. Roots from common reed (Phragmites communis) growing in nearby brooks and lakes and from the rush (Juncus effusus) growing on fenny areas that were regularly flooded by contaminated water were analyzed, and the metal concentrations in the hepato-pancreas of crayfish (Astacus fluviatilis) caught in the area were also determined. The waste tips were drained by three different brooks, all of which ultimately reached Lake Risten and further lakes downstream. The metal concentrations in the biosphere in and around the brooks and the lakes were increased up to 20-fold as far downstream as Lake Yxningen, about 15 km from Bersbo. The western part of the fenny area that was to be drained was flooded by a brook that had first passed through a marshy area abundantly overgrown with reeds, where most of the metals were retained; this western area was therefore only slightly contaminated. The eastern part of the fenny area also received a direct flow of metal-contaminated water from another brook, and metal concentrations in this part were therefore much higher. (Author's abstract)
W86-01280

RENAL PATHOLOGY IN FISH (PUNTIUS CONCHONIUS HAM.) FOLLOWING EXPOSURE TO ACUTELY LETHAL AND SUBLETHAL CONCENTRATIONS OF MONOCROTOPHOS,
D.S.B. Constituent Coll., Naini Tal (India). Dept. of Zoology.
S. Kumar, and S. C. Pant.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, p 228-233, August, 1985. 6 Fig, 6 Ref.

Descriptors: *Monocrotophos, *Fish, *Toxicity, Insecticides, Organophosphate pesticides, Water pollution effects, Pesticide toxicity, Pathology, Kidney.

Pathological changes in the kidney as a result of exposing the teleost Puntilus conchonius to acutely lethal and sublethal concentrations of the organophosphate insecticide monocrotophos are reported. The release of fish into monocrotophos solutions immediately resulted in very fast and erratic swimming which calmed down to normal movements within 2-3 hr. In acutely lethal concentrations, the initial excitement was accompanied by occasional jumping. Externally, the kidneys of acutely as well as sublethally treated fish were swollen and enlarged in comparison to their normal size. In acute concentration, some significant changes were noted in the kidneys of P. conchonius. Within 24 hr, the glomeruli of the majority of Malpighian corpuscles had undergone a marked contraction so that a prominent gap was seen between them and the capsular walls. In sublethal bioassay, as early as 2 days post exposure, vasodilation and tubular atrophy by way of hydropic vacuolation in the cells had become quite evident. Monocrotophos appears to be a stronger nephral poison than formothion for fish as, besides hydropic degeneration of tubules, it also caused glomerular contraction, vasodilation and dissolution of lymphodial tissue to form blood-sinuses. (Baker-IVI)
W86-01281

EFFECT OF ANILINE ON CHLORELLA VULGARIS,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
H. M. Ammann, and B. Terry.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, p. 234-239, August, 1985. 3 Fig, 8 Ref.

Descriptors: *Aniline, *Algae growth, *Chlorella, *Water pollution effects, Organic compounds, Industrial wastes, Dye industry wastes, Respiration, Photosynthesis.

Release of hazardous waste into the aquatic ecosystem produces a variety of complex responses beyond lethality to specific organisms. Hidden injury, such as inhibition of photosynthesis, or changes in oxygen consumption, must significantly affect the role that a primary producer plans in the food pyramid. Threshold concentrations of aniline (a component of dye industry effluents) which affect growth of algae are established. Results show that aniline not only significantly affects growth of Chlorella vulgaris, but also affects respiration and photosynthesis. Comparison of the growth curve with oxygen consumption at 255.5 ppm may explain decreased oxygen consumption as a factor in decreased population density. However, the decline in rate of photosynthesis occurred at an aniline concentration (173.44 ppm) below that considered critical for growth. Since Federal standard emphasize effects on growth as a primary determinant in establishing exposure limits for aquatic organisms to chemical compounds it seems obvious that this is not the only parameter to be measured if aquatic ecosystems are to be preserved. Primary producers would be eliminated over time through sub-lethal exposures with subsequent severe damage, if not elimination of entire food pyramids. (Baker-IVI)
W86-01282

GENOTOXIC ACTIVITY OF PARTICULATE MATERIAL IN PETROLEUM REFINERY EFFLUENTS,
McMaster Univ., Hamilton (Ontario).
C. D. Metcalfe, R. A. Sonstegad, and M. A. Quilliam.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, p 240-248, August, 1985. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Oil industry, *Industrial wastes, *Particulate matter, *Genotoxicity, Ames test, Mutagenicity, Clastogenicity, Water pollution effects, Effluents.

The genotoxic hazard associated with the discharge of suspended particulates in oil refinery effluents was evaluated. Particulate extracts were tested by in vitro assays for mutagenic and clastogenic activity, both with and without mammalian microsomal activation. In 2 of 3 conventional refineries tested significant mutagenic activity was found in the particulate component of
and one particulate extract gave a po
sponse in a sister chromatid exchange a
mutagenic activity of extract residues, c
on a revertants per mg basis was lower
activities reported for many other comp
tures. The low genotoxic activity of resic
particulates would seem to indicate tha
charge of mutagens in refinery effluent
However, the amount of this residue re
particulates from a refinery may total ton
Based upon a mutagenic response of 52 r
per microgram of benzo(a)pyrene in the A
each mg of residue extracted from Re
particulates contains mutagenic activity e
of 1.9 micro-g of benzo(a)pyrene. There
charges from this refinery are equivalent
genic yield to approximately 1.0
benzo(a)pyrene per day. It is possible t
term accumulation of genotoxic compou
refineries may represent a hazard to s
drinking water. The magnitude of thi
would depend on parameters affecting th
the suspended particulates and associat
toxic compounds. (Baker-IVI)
W86-01283

**EFFECT OF POLYNUCLEAR HYD
BONS ON ALGAL NITROGEN FI
(ACETYLENE REDUCTION),**
Oklahoma State Univ., Stillwater. Dept. o
gy.
M. V. Bastian, and D. W. Toetz.
Bulletin of Environmental Contaminat
Toxicology, Vol. 35, p 258-265, August,
Fig, 28 Ref.

Descriptors: *Polynuclear hydrocarbons
growth, *Nitrogen fixation, *Acetylene r
Nitrogen, Bioassay, Hydrocarbons, Napl
Phenanthrene.

The reduction of acetylene to ethylene w
mined as a measure of the capacity of an
to fix atmospheric nitrogen and reduce
assimilable form. The primary advantage
assay is its speed since chemical expos
quantitative chromatographic analysis can
plete in a few hours. Cells exposed to nap
had markedly lower acetylene reduction
(ARA) at all levels of exposure than the
Cells exposed to phenanthrene also reduce
lene at a lower rate. Exposure of cells to
ringed PAHs resulted in a lower rate of A
at higher exposure levels or in no effects. E
of cells to four-ringed compounds resulted
a slight reduction at the highest exposure
in no inhibition. Attempts to correlate sta
either the absolute or relative decrease in
toxicant concentration or to the partitio
cients of toxicants were unsuccessful. It h
expected that standardized physiological
the exposed cells would be achieved durin
nential growth. However, this was not t
Different responses may be due to change
affect the enzyme systems responsible fo
The results suggest that workers should ru
al experiments when testing a compound f
effects on ARA, particularly if the compou
low solubility in water. (Baker-IVI)
W86-01285

5D. Waste Treatment Processe

**MICROFAUNA DISTRIBUTION IN SHA
MACROPHYTE-COVERED BASINS,**
Parma Univ. (Italy). Ist. di Ecologia.
P. Madoni, and P. Viaroli.
Verhandlung Internationale Vereinigung L
gie, Vol. 22, No. 4, p 2353-2355, 1985. 3 Fig

Descriptors: *Protozoans, *Duc
*Wastewater treatment, *Macro
Wastewater lagoons, Microorganisms,
composition, Species distribution.

Succession of ciliated Protozoa was obse
May and June and again in August through
ber in two ponds in which Lemna gibba
weed) was being cultivated. The two basin

nnected by gravity, and had a total area
n; each basin had an average depth of
ie system was fed with sewage from
lagoons, which received the effluents
farming operation. Metopus spiralis was
nce on the bottom of the second basin;
ll ciliates were found in the 0.0-0.05 m
er. The species composition and distri-
liated Protozoa were similar in the two
ite differences in physico-chemical con-
despite the fact that L. gemma was not
n the second basin in the second phase
riment. In basin 1, development of a
quantity of microphytes resulted from
eeding, with a net increase in chloro-
rofauna development was not favored
nditions. The layer of macrophytes,
uckweed, seemed to be a favorable
for ciliated microfauna, particularly
species. The first colonization phase
erized by swimming or planktonic cili-
Didinium nasutum, Mesodinium pulex,
caudatum, and Tracheophyllum pusil-
tic forms ultimately succeeded these
rticella convallaria, V. microstoma,
vaginatum, and Chilodonella uncinata
e particularly associated with duck-
ester-IVI)

**IE DETERMINATION OF THE
OF THE EFFLUENT FROM ACTI-
DGE PLANTS ON THE BASIS OF
IRATION ACTIVITY (KURZZEI-
JNG DER ABLAUFQUALITAT
BTSCHLAMMANLAGEN ANHAND
NGSAKTIVITAT),**
schaftlich-Technisches Zentrum der
l Papierindustrie, Heidenau (German

J. Milz.
himica et Hydrobiologica, Vol. 13,
, 1985. 3 Fig, 2 Ref.

*Activated sludge process, *Effluent,
Process control, Pulp wastes,
treatment, Biochemical oxygen
ity control.

the quality of the effluent from an
ge plant for wastewaters from the
roduction the respiration of an acti-
ample in air-saturated water is deter-
without the addition of substrate
ation) and after that with an addition
methanol, substrate respiration) by
e Clark-electrode. The measuring
gned by means of zero displacement
that the difference of the oxygen
is indicated by a time relay as the
tient. Between the ground respira-
ffluent concentration of BOD5 exists
sitive regression, which can be used
the plant. The determination of the
ration serves only for checking with
aps given inhibition of the conver-
by the activated sludge. The deter-
ie activity of the activated sludge
nly 20 min; inclusive of the required
of the dry matter of sludge, the
ides a well reproducible measured
iochemical conversion in the acti-
lant within 1-1.5 h. (Author's ab-

**OF INDUSTRIAL
RS CARRYING OILY EMUL-
ACTANS AND SULPHATES,**
nical Univ. (Poland). Inst. of Envi-
tion Engineering.
d B. Gomolka.
mica et Hydrobiologica, Vol. 13,
1985. 3 Fig, 4 Tab, 4 Ref.

etergents, *Oil pollution, *Sulfates,
stewater, *Wastewater treatment,
pitation, Barium chloride, Coagula-
ption, Polyurethane foam.

lutants present in the wastewater
ial plant producing surfactants and
other chemicals used in the textile, leather and cosmetic industries are detergents, oily emulsions, sulfates and organics. Laboratory investigations show that the removal efficiencies for detergents and oily emulsions are high when the wastewater is treated in a two-stage process consisting of chemical precipitation with barium chloride and alum coagulation. The coagulation may also involve the addition of sulfates in order to provide for a complete removal of barium ions. The effluent is clarified and colorless, and the concentrations of pollutants present comply with the required standards. An advantage to the use of barium chloride is that the detergents and oily emulsions present in the wastewater are precipitated. Sulfates, which occur at concentrations above the admissible levels, are also subject to precipitation. Oil spills can be successfully removed with polyurethane foams characterized by a high sorbing capacity. (Moore-IVI)
W86-01014

DESIGN AND OPERATION OF BARDENPHO PLANTS IN AN AFRICAN COUNTRY,
Meiring and Partners, Pretoria (South Africa).
J. L. Barnard.
Water Pollution Control, Vol. 83, No. 4, p 443-449, 1984. 4 Fig, 3 Tab.

Descriptors: *Wastewater treatment, *South Africa, *Bardenpho process, Nutrient removal, Design criteria, Biological wastewater treatment, Operation, Phosphates, Aeration.

The suitability of the Bardenpho process for nutrient removal prior to discharge to stream was investigated in South Africa for sewage treatment. Unfortunately, the plants were operated with a minimum of analytical data. The COD:Total N ratio of the crude sewage for all plants was favorable, being mostly about 12:1. This may decrease to below 10:1 after primary sedimentation. The type of design used for the rural plant No. 2 is in many ways similar to channel type plants but has several other advantages: the aeration basin could be much deeper and the plant more compact, vertical spindle surface aerators could be used in the Carousel system allowing for larger individual units to be used; aeration and denitrification could be controlled simply by switching aerators in and out using timers and by manual weir control, the aerators could be concentrated towards the outlet of the basin thus ensuring that a good aerated regime exists before the final clarifier and a high degree of nitrification is achieved with good denitrification, a quick turn around of the bacterial mass to the anoxic zone, and overall simplicity of the system. While it is sometimes felt that it takes less skill to operate a biological filter plant with chemical additions for phosphate removal, this could be true only if no attention is paid to cost and to secondary pollution that results, as all that is required is to overdose the plant in order to precipitate phosphates. (Baker-IVI)
W86-01015

TREATMENT OF WASTE WATER FROM THE LEATHER INDUSTRY,
Leather Industries Research Inst., Grahamstown (South Africa).
D. R. Cooper, S. G. Shuttleworth, and N. P. Slabbert.
Water Pollution Control, Vol. 83, No. 4, p 450-454, 1984. 7 Tab.

Descriptors: *Tannery wastes, *Wastewater treatment, *Industrial wastes, Aeration, Flotation, Activated sludge process, *Biological wastewater treatment, Chromium, Sulfides, Suspended solids, Effluents.

Possible suggestions are offered for the treatment of effluent from a chrome leather tannery. For mixed tannery effluent, all process liquors should be balanced and aerate in balancing tanks for 24 hr to remove sulfide. This effluent would not be suitable for municipal discharge because of high concentrations of SS, settleable solids and chromium content. Physico-chemical treatment involves ferric chloride and polyelectrolyte dosing plus air flotation. This effluent should be suitable for municipal discharge since most of the chromium would have been removed together with the suspended solids. The lower oxygen demand of the treated effluent will ensure acceptability of the effluent as far as organic content is concerned. Only the inorganic levels, as reflected by the total dissolved solids (mainly inorganics), sulfate and chloride contents, could possibly exceed the discharge limits of some municipalities. Further organics removal could be obtained by biological treatment, by activated sludge or high rate filter. A stepwise treatment, i.e. physico-chemical followed by biological treatment, is better and easier for highly-polluted tannery effluents than a single activated sludge process. Fresh water discharge would still not be possible since with even the best available effluent treatment of tannery effluents, the general/special standards for rivers will not be met. (Baker-IVI)
W86-01016

POTENTIAL OF ANAEROBIC DIGESTION FOR TREATING LIQUID WASTES,
Birmingham Univ. (England). Dept. of Civil Engineering.
C. G. Forster.
Water Pollution Control, Vol. 83, No. 4, p 484-490, 1984. 7 Fig, 2 Tab, 26 Ref.

Descriptors: *Wastewater treatment, *Anaerobic digestions, Industrial wastes, Evaluation, Anaerobic expanded bed process, Biological wastewater treatment.

The potential for using anaerobic digestion as a method for treating liquid wastes was examined. Laboratory scale digesters have been shown to be useful in evaluating the compatibility of a process and a particular effluent. Design options that are available are considered along with design criteria which must be met. The results indicate that the anaerobic expanded bed (AEB) process exhibits a large degree of dispersion irrespective of the hydraulic retention period being used. In other words, the system is well-mixed. No short circuiting was occurring. The data also indicates that the AEB system, and probably other types of anaerobic digesters, is not a suitable method for the treatment of effluents with a strength as low as that of normal domestic sewage unless it is considered merely as a roughing process. This study also showed an additional and interesting point. On a number of occasions air entered the system, either when pump tubing failed or when the bed had to be opened for minor repairs. This did not appear to have any significant effect on the performance indicating that, contrary to most of the literature, the anaerobic microbial flora is extremely robust. (Baker-IVI)
W86-01018

APPLICATION OF ANAEROBIC PACKED-BED REACTORS TO INDUSTRIAL WASTE-WATER TREATMENT,
Newcastle upon Tyne Univ. (England). Public Health Engineering Div.
G. K. Anderson, K. J. McKeown, and T. Donnelly.
Water Pollution Control, Vol. 83, No. 4, p 491-498, 1984. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Anaerobic digestion, *Industrial wastes, *Packed bed reactors, Filters, Filtration, Biodegradation, Biological wastewater treatment.

The treatment of organic waste waters by anaerobic packed-bed reactors offers considerable advantages over other types of anaerobic treatment systems. They have been proven over a wide range of industrial waste waters with considerable variation in concentration of organic matter. The reactors are able to maintain a high biomass concentration with attachment of both acidogenic and methanogenic bacteria. This enables a high BOD load to be applied while concurrently offering stability under varying load conditions and inhibitive conditions. Careful research and design can optimize treatment efficiency and methane production and, together with control of sulfide production in the appropriate situations, it is anticipated that a wide range of wastewaters will be treated by this method. (Baker-IVI)

W86-01019

ANAEROBIC TREATMENT OF WASTE WATERS IN THE BEET SUGAR INDUSTRY,
British Sugar Corp. Research Labs., Norwich (England).
M. Shore, N. W. Broughton, and N. Bumstead.
Water Pollution Control, Vol. 83, No. 4, p 499-506, 1984. 4 Fig, 3 Tab, 22 Ref.

Descriptors: *Anaerobic digestion, *Wastewater treatment, *Food processing industry, Beets, Industrial wastes, Water reuse, Methane, Fuel.

Beet sugar production requires substantial volumes of water, but in modern beet sugar factories most of it is recycled. The theoretical volume of effluent at the British Sugar factory at Bury St. Edmunds exceeds 100 tcmd, but treatment and re-use have reduced this to only 4.8 tcmd. Most of this originates from incoming water in the beets which is not eliminated either in the end-products or in evaporation to atmosphere. Anaerobic processes developed in the last decade specifically for the beet sugar industry have the advantages of a much lower input energy cost and production of the valuable fuel methane to offset their high capital cost. The four main methods of anaerobic treatment in general use in the industry are the Anamet, IRIS, Anodek, CSM processes. The Anamet plant commissioned at Bury St. Edmunds factory during the 1982-1983 processing season is described. During the last three of the five weeks operations for which results are available, the plant routinely removed about 90% of the influent COD and had a daily methane production which, maintained for a full processing season, would be worth more than 22,000 pounds as a fuel oil replacement. When fully operational, the plant is expected to yield methane worth nearly three times this amount from the removal of more than 16 t COD/day. (Baker-IVI)
W86-01020

ANAEROBIC DIGESTION OF AGRICULTURAL WASTES,
Rowett Research Inst., Bucksburn (Scotland). Dept. of Microbial Biochemistry.
P. N. Hobson.
Water Pollution Control, Vol. 83, No. 4, p 507-513, 1984. 1 Tab, 11 Ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Farm wastes, Nitrogen, Bacteria, Methane, Energy, Animal wastes, Crop wastes, Silage liquid, Waste disposal.

Gas production from the farm digester treating animal slurries could be boosted at times by adding to the slurry silage liquid (a potential cause of heavy pollution of water courses), and crop wastes. Waste vegetable matter would have to be macerated before it could be pumped with slurry. Maximum use of all products of digestion is desirable and uses of digested slurry other than for fertilizer are envisaged and are being tested. A protein, or protein plus ammonia, nitrogen supplement to farm animal feeds is a possibility. A problem arises due to the large liquid volume of the slurry. A suitable, low-cost, low-energy method of concentrating and drying the slurry solids containing the bacterial protein has not yet been devised. Making silage could be a way of mopping up the liquid, or mixing with grain to form a liquid feed is also possible. Hydroponics, fish farming, growing of worms or algae, are all possible uses for digested slurries; experiments on these and other uses are being carried out. (Baker-IVI)
W86-01021

EXPERIENCE WITH THE ANODEK PROCESS,
Dunlop Bioprocess, Birmingham (England).
G. G. Morris, and S. Burgess.
Water Pollution Control, Vol. 83, No. 4, p 514-520, 1984. 1 Fig, 10 Tab, 5 Ref.

Descriptors: *Anodek process, *Methanogenesis, *Anaerobic digestion, Methane bacteria, Acetogenic bacteria, Biological wastewater treatment, Biogas.

Anaerobic digestion is usually achieved in one step with the entire process (acidogenesis and methanogenesis) taking place in one reactor. The two stage Anodek process is based on the fact that the methanogens can only utilize a limited number of intermediates. These are methanol, hydrogen, formate and acetate. The methanogens have to directly remove the hydrogen produced by the obligatory hydrogen producing acetogenic (OHPA) bacteria in order to favor the thermodynamic conditions for growth of their syntrophes, the OHPA bacteria. Therefore, technically the OHPA bacteria and the methanogens have to exist in physical proximity, hence in one particular reactor. In practical terms Anodek is a method for the production of methane gas and the treatment of aqueous solutions of organic compounds by means of a two stage anaerobic fermentation process. The first stage is used to solubilize/hydrolize the effluent and provide the second stage with an optimum of constant feed by various means. The second stage is a methane reactor where methane gas is produced from the conditioned feed. About 70% of the COD present in the wastewater can be rapidly converted into biogas, representing a 95% BOD reduction. (Baker-IVI)
W86-01022

LEACHATE TREATMENT WITH PARTICULAR REFERENCE TO AERATED LAGOONS,
Water Research Centre, Stevenage (England).
P. J. Maris, D. W. Harrington, and G. L. Chismon.
Water Pollution Control, Vol. 83, No. 4, p 521-538, 1984. 7 Fig, 13 Tab, 36 Ref.

Descriptors: *Leachates, *Wastewater treatment, *Aerated lagoons, Landfills, Clarification, Aeration, Waste disposal, Biological wastewater treatment, Chemical treatment, Sludge.

The development of scientific landfill management will lead to increasing constraints on leachate disposal. Leachate has particular problems notably organic strength, metals and high ammonia N content. The age and the method of emplacement of the waste play an important part in determining the nature of the leachate. Leachates from recently emplaced wastes are amenable to biological treatment while leachate from more aged waste which contains more refractory compounds may need both chemical and biological treatment. Aerobic treatment of leachate will give rise to a large quantity of sludge which will require thickening and disposal. The volume of leachate produced from a landfill will be dependent upon climatic conditions, the rate of infiltration and the degree of compaction of waste. The most effective way of reducing the volume of dump leachate is by good site engineering and management. Leachate is deficient in phosphorus, which, for effective biological treatment, must be added as a nutrient supplement. The most effective biological treatment is aerated lagooning, followed by clarification. Other options include chemical treatment, the anaerobic process, activated-sludge treatment and rotating biological contactors. Aeration of strong leachate produces large volumes of sludge. This settles readily and may be thickened up to 5.6-7.7% dissolved solids. It is imperative that the treatment process should be simple, reliable and require low maintenance and operating expertise. (Baker-IVI)
W86-01023

MOVEMENT OF SEPTIC TANK EFFLUENT THROUGH SANDY SOILS NEAR PERTH. I. MOVEMENT OF NITROGEN,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Animal Production.
For primary bibliographic entry see Field 5B.
W86-01034

MOVEMENT OF SEPTIC TANK EFFLUENT THROUGH SANDY SOILS NEAR PERTH. II. MOVEMENT OF PHOSPHORUS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Animal Production.
For primary bibliographic entry see Field 5B.
W86-01035

FLOW UNDER TILT SURFACE FO RATE SETTLING,
Osaka Univ. (Japan). Dept. of Chemical ing.
S. Shiba.
Journal of Environmental Engineering, No. 3, p 285-303, June, 1985. 5 Fig, 3 T 3 Append.

Descriptors: *Settling tanks, *Flow st Water treatment, Wastewater treatmen tion, Density, Mathematical models, Velocity, Sedimentation.

A clear layer flow rising under incline (particle-free flow stratified on the which can be utilized for particle settlin ment, has been theoretically analyzed apply it to design and operation of hig tlers in water and wastewater treatment proves to be driven by settling convect the density difference between the clear the suspension. A mathematical model f simulation has been obtained by making boundary layer approximation and the averaged inertia terms in the momentum A dimensionless number, T, which co model and is given by the ratio of Grash Gr, to Reynolds number, R, plays an role in the flow. The flow velocity and thickness predicted by the analytical agree fairly well with previous experime observed in a batch settler to verify th (Author's abstract)
W86-01040

CALCIUM SULFATE SOLUBILITY GANIC-LADEN WASTEWATER,
Westinghouse Electric Corp., Carls Waste Isolation Pilot Plant Project.
I. Banz, and R. G. Luthy.
Journal of Environmental Engineering, No. 3, p 317-335, June, 1984. 4 Fig, 5 T

Descriptors: *Calcium sulfate, *Solubilit ic matter, *Wastewater, Coal wastewater, Water reuse, Makeup wate water.

Calcium sulfate solubility product and dissociation constant were measured water, and these results were employe with a pretreated coal conversion wastewater to assess the tendency fo matter in the wastewater to function as ing agent for calcium. It was demonst wastewater organic matter interacted wi to form a calcium-organic complex. The this interaction in wastewater was as sig that for formation of the CaSO4(0) ic assessing solubility of CaSO3. It was s the organic matter complexed with calc extent comparable to humic acid, and complexing strength was similar to that for citrate when compared on an equiva or TOC basis. The results of this study a tant for evaluating CaSO4 scale-forming if wastewater is to be reused as makeup w evaporative cooling tower. (Author's abs
W86-01042

HEAD-DISCHARGE RELATION FOR SHAFT,
Ecole Polytechnique Federale de Lausan zerland). Chaire de Constructions Hydrau
For primary bibliographic entry see Field
W86-01053

REMOVAL OF PESTICIDES IN WA MICROBIAL CELLS ADSORBED TO TITE,
Queensland Univ., Brisbane (Australia). Microbiology.
For primary bibliographic entry see Field
W86-01057

IDENTIFICATION AND TREATABIL ORGANICS IN OIL SHALE RETORT
Queensland Univ., Brisbane (Australia).

Engineering.
ɔson, M. Stephenson, P. F. Greenfield,
F. Bell.
search, Vol. 19, No. 7, p 849-856, 1985. 5
, 13 Ref.

rs: *Oil shale retort water, *Organic
is, *Wastewater treatment, Biodegrada-
orption, Activated carbon, Oxidation,

y GC-MS of the process water derived
her Assay retorting of oil shale from
ustralia has provided positive identifica-
major organic constituents present. This
detailed analysis of retort water from
oil shales and showed that the com-
ged from being highly biodegradable to
bitory and resistant to biological oxida-
major classes of compounds found in a
sample included normal carboxylic
pyridines, quinolines and cyclic satu-
unsaturated ketones. Separation of the
r into its acid, base and neutral fractions
ht about by solvent extraction using
chloride. A series of treatability studies
rt water confirmed the hypothesis that
ion of the organic carbon was amenable
l treatment. In addition, high ammonia
er inhibited biological action. Adsorp-
retort water with activated carbon
t successful in removing the non-biode-
action of the organic species. Chemical
y ozone does not appear attractive be-
ks the specificity of adsorption. (Au-
ct)

OLLUTION IN THE SIMAV RIVER, AND VARIOUS METHODS OF EMOVAL,
ientific and Industrial Research Inst.,
key). Dept. of Chemical Engineering.
Guclu, E. Soner, and T. Balkas.
rch, Vol. 19, No. 7, p 857-862, 1985. 9
9 Ref.

*Boron, *Wastewater treatment,
age, *Simav River, *Turkey, Adsorp-
hange, Magnesium oxide, Resins, Cel-
pollution control.

nines in the Bigadic district of Turkey
gnificant amounts of drainage water
av River, which supplies irrigation
ricultural land. Boron removal from
waters using alpha-cellulose, magnesi-
boron-specific resin Amberlite IRA-
stigated. Both the adsorption method
ium oxide and the ion-exchange oper-
fective in removing boron from the
ers. Cellulose as an adsorbent has a
iciency. MgO can be used for three
es with 85% removal efficiency but
arged and regenerated after the third
mption of 18,100 tons of MgO per
removal system makes this process
. Boron-specific resin Amberlite
ree-amine form is also uneconomical
sive regeneration steps. The capacity
n salt-form was found to be 1.5 mg
n at 10% boron leakage and at a flow
/l. The possibility of reuse of 90% of
t and production of 4400 tons of
the removal system with salt-form
resin would compensate for the
f chemicals and also provide some
-IVI)

**REMOVAL FROM AQUEOUS SO-
FLY ASH,**
u Univ., Varanasi (India). Inst. of

G. Prasad, and V. N. Singh.
h, Vol. 19, No. 7, p 869-873, 1985. 7
Ref.

*Adsorbents, *Copper, *Fly ash,
eatment, Adsorption, Heavy metals,
concentration, Temperature effects.

Adsorption at solid-solution interfaces is an important means of controlling the extent of pollution due to metallic species in industrial effluents, but the use of activated carbon is not suitable for developing countries due to its high cost. The use of fly ash from thermal powerplants as an adsorbent for the removal of Cu(II) for aqueous solutions was studied and 100% removal was noted when the solution concentration was initially at 1.0 x 10 to the -4 M. The removal of Cu(II) by adsorption on fly ash is concentration, pH and temperature dependent. The kinetics of adsorption indicates the process to be diffusion controlled. The Langmuir constants were calculated at different temperatures, and the adsorption was found to be endothermic (delta H = 15.652 kcal/mol). The maximum removal is observed at pH 8.0. The hydrolyzed species of Cu(II) are involved in complexation with surface active sites of fly ash. (Moore-IVI)
W86-01062

PERSISTENT CHEMICALS IN PULP MILL EFFLUENTS OCCURRENCE AND BEHAVIOUR IN AN ACTIVATED SLUDGE TREATMENT PLANT,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
C. Leuenberger, W. Giger, R. Coney, J. W. Graydon, and E. Molnar-Kubica.
Water Research, Vol. 19, No. 7, p 885-894, 1985. 5 Fig, 5 Tab, 37 Ref, 1 Append.

Descriptors: *Pulp wastes, *Activated sludge process, *Chlorinated hydrocarbons, Wastewater treatment, Chlorinated phenols, Chloroform, Chlorinated terpenoids, Chlorinated resin acids, Adsorption, Water pollution, Switzerland.

In wastewater effluents of a Swiss pulp mill more than 50 organic chemicals were identified including chlorinated phenols, chloroform, chlorinated terpenoids and chlorinated resin acids. Quantitative determinations were carried out to investigate the behavior of the most abundant constituents during wastewater treatment in an activated sludge process. In particular, the chlorinated compounds were only partly eliminated. The lipophilic chlorinated phenols were physically absorbed to some extent into the activated sludge biomass. The importance of this nonbiological elimination mechanism was evaluated by applying distribution coefficients between activated sludge particles and water which were determined for a series of chlorinated phenols. Chloroform and other purgeable compounds were removed mainly by transfer into the ambient air. The impact of the persistent wastewater constituents on the water qualtity in the receiving River Aare was assessed. It was estimated that the concentrations of chlorinated phenols in the river caused by the discharge of the treated pulp mill wastewater are about 10 time lower than the levels of pentachlorophenol which typically occur in Swiss rivers receiving effluents from municipal wastewater treatment plants. (Author's abstract)
W86-01064

LEACHATE TREATMENT WITH NITRIFICATION OF AMMONIA,
Cleanaway Ltd., Rayleigh (England).
K. Knox.
Water Research, Vol. 19, No. 7, p 895-904, 1985. 8 Fig, 5 Tab, 11 Ref.

Descriptors: *Landfill leachates, *Wastewater treatment, *Nitrification, *Ammonia, Leachates, Activated sludge process, Trickling filters, Biological wastewater treatment, Organic carbon, Temperature effects, Seasonal variation.

Small outdoor activated sludge and trickling filter plants were operated for 2 years to investigate nitrification in a leachate from a long-established co-disposal landfill. There has been little long-term change in leachate quality at the site, but seasonal fluctuations were observed. Leachate ammonia nitrogen concentrations ranged from 150 to 550 mg/l while total organic carbon (TOC) concentrations ranged from 200 to 500 mg/l. This suggested that NH3-N concentrations were influenced by factors additional to those which produced the variations in TOC concentrations. Very little of the TOC was degradable and BOD:NH3-N ratios were typically 1:3. In the activated sludge plant, clarification was poor. This was at least partly attributed to the low BOD:NH3 ratio. Fewer problems of this sort occurred in the biological filter. Nitrification was successfully established in both plants, and curves were established for the response of the kinetics to different temperatures. The highest ammonia removal rate achieved in the activated sludge plant was 131 g N/kg VSS/day achieved at an average temperature of 13 C. The maximum removal rate in the trickling filter was 309 mg N/sq m/day, at 16 C. This is similar to nitrification rates reported for sewage at similar temperatures. The sensitivity of the process to temperature and the disproportionate production of leachate in winter months indicate that full-scale plant design would be optimized if leachate were stored on-site during winter months for treatment during warmer weather. (Moore-IVI)
W86-01065

EPIDEMIOLOGICAL EVIDENCE FOR HELMINTH AND CHOLERA TRANSMISSION BY VEGETABLES IRRIGATED WITH WASTEWATER: JERUSALEM - A CASE STUDY,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
H. I. Shuval, P. Yekutiel, and B. Fattal.
Water Science and Technology, Vol. 17, No. 4/5, p 433-442, 1985. 3 Fig, 11 Ref.

Descriptors: *Wastewater irrigation, *Epidemiology, *Cholera, *Parasites, *Jerusalem, *Israel, Public health, Diseases, Wastewater disposal, Wastewater treatment, Water reuse, Pathogens, Agriculture.

This paper reviews and reanalyzes epidemiological data on the transmission of the helminthic diseases ascariasis and trichuriasis as well as cholera by vegetables and salad crops irrigated with untreated wastewater in Jerusalem between 1935 and 1982, based on a series of published papers and unpublished reports not generally available to professionals in the field of water pollution control. The findings provide strong evidence that both Ascaris and Trichuria infections were actively and massively transmitted to the general public who consumed vegetables irrigated with raw wastewater. The levels of infection dropped dramatically when the supply of contaminated vegetables was cut off but increased again rapidly on reintroduction of the wastewater-irrigated crops. The infection level subsided again when the practice was finally stopped in 1970. The epidemiological evidence from the 1970 cholera outbreak in Jerusalem indicates that wastewater-irrigated vegetables were the primary route of secondary infection once a few subclinical or clinical cases of cholera entered the city from areas outside the country where a cholera epidemic was underway. The evidence also indicates that farmers in an area where cholera is not endemic are particularly at risk when practicing irrigation with raw wastewater from a city undergoing a cholera outbreak. The need to treat wastewater to remove these pathogens prior to the irrigation of such vegetable crops is stressed. (Author's abstract)
W86-01173

WASTEWATER TREATMENT BY ARTIFICIAL WETLANDS,
Ecological Research Associates, Davis, CA.
R. M. Gersberg, B. V. Elkins, and C. R. Goldman.
Water Science and Technology, Vol. 117, No. 4/5, p 443-450, 1985. 5 Fig, 1 Tab, 10 Ref. EPA grant CR-807299-03-0, California Department of Water Resources grant B-53459 AM IV.

Descriptors: *Wastewater treatment, *Artificial wetlands, *Wetland treatment, Secondary wastewater treatment, Advanced wastewater treatment, Nitrogen removal, Biochemical oxygen demand, Suspended solids, Costs.

This report describes studies of artificial wetlands at Santee, California which demonstrate the capacity of these systems for integrated secondary treat-

ment (BOD and suspended solids removal) and advanced treatment (nitrogen removal) of municipal wastewater effluents. When receiving a blend of primary and secondary wastewaters at a blend ratio of 1:2 (6 cm per day 1 degrees: 12 cm per day 2 degrees), mean removal efficiencies for a complete year of operation from July, 1982 through July, 1983 were 80% for total nitrogen (TN) and 80% for total inorganic nitrogen, with the mean inflow TN level of 21.5 mg/l reduced to a mean value of 4.3 mg/l in the wetland effluent. The BOD and suspended solids removal efficiencies were 93% and 88% respectively. The mean wetland effluent values for both BOD and suspended solids were below the 10/10 mg/l standard for advanced secondary treatment. When primary effluent was the sole source of inflow to the artificial wetlands, BOD and suspended solids levels approaching the quality of a secondary treated effluent (30/30 mg/l) could be attained at an application rate of 6-8.3 cm per day. In this case, mean BOD and suspended solids removal efficiencies for the complete year from July, 1982 through August, 1983, were 78% and 80% respectively, with the effluent levels reduced to mean values of 33 mg/l for BOD and 10 mg/l for suspended solids. At the application rate of 6 cm per day, the study shows that only 16 acres (6.5 ha) of the constructed wetlands would be required to treat 3785 cu m of primary wastewaters to secondary treatment levels. Data on capital, and operating and maintenance costs show that artificial wetlands are competitive with other treatment technologies available to small to medium sized communities. (Author's abstract)
W86-01174

USE OF PERACETIC ACID IN OPERATIONAL SEWAGE SLUDGE DISPOSAL TO PASTURE,
Interox Chemicals Ltd., Widnes (England).
J. A. L. Fraser, A. F. Godfree, and F. Jones.
Water Science and Technology, Vol. 17, No. 4/5, p 451-466, 1985. 1 Fig, 8 Tab, 50 Ref.

Descriptors: *Peracetic acid, *Disinfection, *Sludge disposal, Salmonella, Parasites, Pathogens, Pastures, Sludge treatment, Bacteria.

Intestinal pathogens and parasites are a problem associated with the disposal of sewage sludge to pasture. Those of major importance are ova of the beef tapeworm (Taenia saginata) and Salmonella bacteria. Techniques for routine monitoring of pathogens and intestinal parasite levels in sludge together with design of simple methods for their removal have intensified, because disposal of sewage sludge to pasture is coming under increasing international surveillance. The performance during field trials of a proprietary peracetic acid compound (containing 36 to 40% w/w peracetic acid), hereafter referred to as PAA (100%), is described. These trials under operational conditions showed it to be a suitable bacterial and ovicidal agent for the disinfection of raw, digested and activated sludges. Concentrations ranging from 250 to 1000 mg PAA/l have achieved up to 99% inhibition of hatching and up to 100% destruction in viability of tapeworm embryos suspended in raw and digested sludges. Similarly these concentrations resulted in 5 log, reduction in salmonellae seeded in raw sludge. A dose of 250 mg PAA/l reduced salmonellae levels from 4600 organism/100 cu cm to < 30/100 cu cm during gravity thickening of surplus activated sludge. Results from 46 tanker loads of consolidated surplus activated sludge revealed that salmonellae levels were reduced from 2400 organisms/100 cu cm to < 30/100 cu cm at doses of 500, 400 and 300 mg PAA/l. At a lower dose of 150 mg PAA/l levels were reduced to within a range of < 30 to 430 organisms/100 cu cm. At optimum disinfection concentrations for the destruction of both bacteria and parasites, PAA was rapidly utilized resulting in safe, readily biodegradable, non-toxic residuals. The technical and practical benefits, principals of disinfecting sludge and ecological safeguards are highlighted in this paper. Use is made of case histories to describe practical operating techniques. (Author's abstract)
W86-01175

SETTLING OF NUTRIENT REMOVAL ACTIVATED SLUDGES,
Johannesburg City Health Dept. Labs. (South Africa).
A. R. Pitman.
Water Science and Technology, Vol. 17, No. 4/5, p 493-504, 1985. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Activated sludge, *Sludge settling, *Aeration, Biological wastewater treatment, Nutrient removal, Dissolved oxygen, Clarifiers, Sedimentation, Sludge age.

The successful operation of the activated sludge process is greatly dependent on final clarifier performance. Final clarifier perfomance is related to activated sludge settling properties and these in turn are usually affected by operating conditions in the biological reactor. The settling properties of activated sludges from four biological nutrient removal plants were surveyed. Activated sludge settling properties showed a fair degree of variability with the two extended aeration plants exhibiting superior settling properties in comparison to the two Phoredox/Bardenpho units. One sludge had poor settling properies due to the presence of excessive filamentous growths. Settling properties could be correlated well with the degree of aeration of the activated sludge. Plants operated with an aerobic sludge age greater than 50% of the total sludge age and with aerobic zone dissolved oxygen levels above 1.0 mg/l tended to produce better settling sludges. Empirically derived constants used in the settling flux theory are correlated with more traditional measures of settling properties. An easy method of using the settling flux approach to clarifier design and operation is presented and a new parameter describing the settling properties of sludges is proposed. (Moore-IVI)
W86-01178

SLUDGE CONDITIONING: EFFECTS OF SLUDGE BIOCHEMICAL COMPOSITION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
P. T. Bowen, and T. M. Keinath.
Water Science and Technology, Vol. 17, No. 4/5, p 505-515, 1985. 2 Fig, 6 Tab, 25 Ref.

Descriptors: *Sludge conditioning, *Chemical composition, Sludge drying, Carbohydrates, Protein, Lipids, Polymer Index, Biopolymers, Bioflocculation.

Variations in response of three different sludges to conditioning with organic polyelectrolytes were evaluated with respect to the carbohydrate, protein and lipid content of the sludges. These biochemicals comprise the surfaces of most sludges. The difference in the concentration of these compounds is intrinsic to the sludge type. Polymer Index (PI), a measure of minimum polymer dose required to achieve maximum dewaterability, was statistically related to each of the three components. Carbohydrate content correlated most strongly with PI. As carbohydrate content increases, PI was found to decrease indicating better polymer performance. Biopolymers, which are composed mainly of carbohydrates may surround the cells forming a highly reactive surface. These exocellular materials also promote bioflocculation. Both actions result in a lower polymer requirement for destabilizing the sludge. Protein and lipid were not observed to have strong correlation with PI. Cellular surfaces and structures are composed of these components. The low correlation indicates these components are less favored than carbohydrates for polymer interaction. (Author's abstract)
W86-01179

HIGHLY EFFICIENT ANAEROBIC DIGESTION WITH THERMAL PRETREATMENT,
Kyoto Univ. (Japan). Dept. of Sanitary Engineering.
M. Hiraoka, N. Takeda, S. Sakai, and A. Yasuda.
Water Science and Technology, Vol. 17, No. 4/5, p 529-539, 1985. 7 Fig, 3 Tab, 10 Ref.

Descriptors: *Anaerobic digestion, *Thermal pretreatment, Wastewater treatment, Activated sludge, Organic matter, Fatty acids, Volatile acids, Methane.

The effectiveness of an anaerobic digestion with thermal pretreatment at a comparativ temperature was examined. The waste a sludge was thermally pretreated in the pr laboratory scale experiment and a pilot pla were conducted. Changes in volatile acids tration, in major constituents of sludge molecular size distribution were examine and after thermal pretreatment and anaer gestion. Thermal pretreatment resulted i crease of more than 30 percent in diges production. The major substrates decompo fats in the pilot plant study. Glyceride fat are decomposed with thermal pretreatm produce volatile acids such as acetic and p acids. The volatile acids are directly util anaerobes to produce methane. Organic such as fats and carbohydrates are depoly with thermal pretreatment and produce intermediate compounds such as higher fat The intermediates are utilized in the a digestion process. These two major effect tate the methane production process. (A abstract)
W86-01180

SLUDGE TREATMENT TECHNOLOG IONIZING RADIATION,
Vyzkumny Ustav Vodohspodarsky, (Czechoslovakia).
M. Sedlacek, M. Koubik, K. Vacek, and J. Rejholec.
Water Science and Technology, Vol. 17, N p 515-562, 1985. 5 Fig, 9 Tab, 20 Ref.

Descriptors: *Sludge treatment, *Irradiatio infection, Sludge thickening, Sludge dispo monella, Economic aspects, Czechoslovakia

The application of radiation hygieniza sludges in sewage works can be affected ondary effects of this process. The change colloidal system of liquid sludges by irr results in an improvement of their thicken pacity, but at the same time produces an inc the demand for polymer flocculants for the tioning of sludges prior to their dewaterin irradiation dose of 3 kGy decreases the co tion of Salmonella senf. by at least 6 orders the same time the reinfection of the sluc prolonged storage is suppressed. Two y field tests showed higher potato and barley with irradiated sludges compared with no ated sludges. The economic evaluation dem ed under Czechoslovak conditions the suitab the use of electron accelerators as radiation and the introduction of ionizing radiation the mechanical sludge dewatering proces thor's abstract)
W86-01181

SLUDGE STABILISATION AND DIS TION BY MEANS OF AUTOTHERMAL BIC DIGESTION WITH OXYGEN,
Johannesburg City Engineer's Dept. Africa).
B. C. Trim, and J. E. McGlashan.
Water Science and Technology, Vol. 17, N p 563-573, 1985. 3 Fig, 3 Tab, 10 Ref.

Descriptors: *Sludge digestion, *Autotherm obic digestion, *Disinfection, Sludge stabili Helminths, Dissolved oxygen, Aerobic dig

Research at pilot-scale was undertaken into ermal aerobic digestion of sludge using oxy demonstrate that sufficiently high temperatu be achieved to ensure the degree of disin that would satisfy the health authorities. T of the helminth Ascaris lumbricoides were the disinfection studies and the dissolved level in the sludge was used as a means of c ling oxygen consumption. The results ac indicate that the system very rapidly atta stable temperature which could be easily tained and which effectively ensured disinf of the sludge at the 2 and 4 day retention p tested, that the treated sludge readily fe anaerobically, that the sludge will not readily and is very difficult to dewater. (Author's ab
W86-01182

AMINATING BIOLOGICAL SLUDGE RICULTURAL USE,
Jniv. (Ontario). Dept. of Civil Engineer-

and J. G. Henry.
ence and Technology, Vol. 17, No. 4/5, 1985. 3 Fig, 8 Tab, 16 Ref.

s: *Bacterial leaching, *Sludge treat-avy metals, Hydrogen ion concentration, Temperature, Cadmium, Copper, Nickel, , Sludge disposal, Land application.

cal oxidation process called bacterial as used to remove heavy metals from ly digested sewage sludge. The purpose ntaminate the sludge so that it could be agricultural land. The leaching process to be affected by pH, aeration and e. At a pH of 4, on aeration rate of 100 ir per liter of sludge per minute and a e of 25 C, the following metal removal were observed: cadmium, 80-85%; 80%; nickel, 70-78% and zinc, 84-90%. nt removal was observed for lead. In removing heavy metals, bacterial leach-es the soil conditioning and fertilizing f the sludge. According to Ontario he sludge used in this study was initial-ptable for use on agricultural lands. fter bacterial leaching, all criteria for on of sludge to agricultural lands were Author's abstract)

ATION OF HEAVY METALS IN LUDGES,
arch Centre, Medmenham (England).
Lab.
. S. Booker, and R. D. Davis.
ce and Technology, Vol. 17, No. 4/5, 85. 3 Fig, 5 Tab, 2 Ref.

*Sludge, *Heavy metals, Chemical Carbonates, Sulfides, Organic com-nium, Chromium, Nickel, Lead, Zinc,

Cr, Cu, Ni, Pb and Zn) have been n representative sewage sludges (pri-ary, digested) by a sequential extrac-e using KNO3 1M (removes the 'ex- fraction), KF 0.5M ('sorbed'), M ('organic'), Na2EDTA 0.1M ('car-HNO3 6M ('sulfide'). Major differ-ng to sludge type were not seen. Cd nly in the 'carbonate' fraction and 38-as in the 'organic' fraction. 43-70% 'sulfide' fraction while > 40% of Ni in the 'exchangeable/sorbed' frac-found predominantly in the 'organic' e' fractions and Zn in the 'organic' complete extraction procedure re-% of the total metals content of the nges in fractionation caused by e and time of extraction are reported. m the first part of a detailed investi-ie chemistry of metals in sewage r's abstract)

PHOTOOXIDATION OF ORGAN-NTS IN WASTEWATER,
Research Organization, Bet-Dagan f Soils and Water.

and Technology, Vol. 17, No. 4/5, . 5 Fig, 5 Tab, 22 Ref.

olar irradiation, *Wastewater treat-xidation, Dye-sensitizers, Organic nts, Disinfection, Bacteria, Viruses, Triazine, Anilides, Detoxification,

resented represents results of a re-v method for using solar energy for industrial wastewater treatment. eeks to develop economical meth-fection and detoxification of hich would result in the reuse of effluents for crop irrigation. Aerated effluents containing dye-sensitizers were exposed to solar irradiation for various periods of time. The influence of the solar energy, absorbed by these sensitizers in the visible range, on the organic matter and anionic surfactants (MBAS) in secondary effluents was checked by determining the COD and MBAS values of treated wastewater. The disinfection potential of this method was followed by bacteriological analyses of running water or secondary effluents, previously contaminated or enriched, respectively, with laboratory cultures of E. coli, bacteriophages (coliphage X and F2) and polio virus (type L-Sc 1). The influence of this photooxidative method was also studied in eutrophic algae present in the Lake of Galilee. It was found that the conditions under which disinfection proceeds also support algicidal processes, causing lethal damage to algal cultures. Further investigations on stable pesticides (uracil, s-triazine and anilide derivatives) in surface water or industrial wastewater showed that such a method can also be used for detoxifying pesticides in these waters. (Author's abstract)
W86-01187

SYNTHESIS MODELING OF MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Universidade Nova de Lisboa (Portugal). Sanitary Engineering Group.
A. S. Camara, C. W. Randall, and L. C. Frair.
Water Science and Technology, Vol. 17, No. 4/5, p 633-644, 1985. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Wastewater treatment, *Optimization, *Model studies, Economic aspects, Costs, Engineering, Tertiary treatment, Efficiency.

The synthesis of wastewater treatment systems refers to the specification of both a system structure, the choice and arrangement of unit processes and operations, and the design of the individual units within that structure so that a set of economic and environmental objectives is fulfilled. Synthesis models allow one to define the minimal cost design for a wastewater treatment system, specifying the system structure and the design of the individual units within that structure. There are still important limitations on cost and engineering data which do not permit a truly optimal design of treatment plants. The major problems in the cost information occur in the tertiary treatment stage. Most of the cost functions of tertiary treatment units are expressed in terms of the plant flow rate and are therefore not related to design variables. As a result, one can not determine optimal dimensions for those units. The main deficiencies in the engineering information are basically in three areas: removal efficiency values for pollutants for most of the tertiary units and some of the secondary units; definition of quantitative relationships between the efficiency of the thickening units and the subsequent digesting and dewatering units; and computation of supernatant flow rate and concentrations. Despite these limitations, it is possible to develop a synthesis model representing an improvement over the available synthesis models. The treatment plant can be considered as a network with loose connections. These weak links allow one to divide it into sub-networks. The synthesis problem is then divided into sub-problems connected by 'tear contraints' (on to each sub-network) and solved using known optimization methods. (Moore-IVI)
W86-01188

F SPECIFIC RNA BACTERIOPHAGES IN SEWAGE: METHODOLOGY AND OCCURRENCE,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. voor Zoonosen Lebensmittelmikrobiology.
For primary bibliographic entry see Field 5A.
W86-01189

TREATMENT OF AGRO-INDUSTRIAL WASTES USING WATER HYACINTH,
Rubber Research Inst. of Malaya, Kuala Lumpur (Malaysia).
C. K. John.
Water Science and Technology, Vol. 17, No. 4/5, p 781-790, 1985. 3 Fig, 4 Tab, 14 Ref.

Descriptors: *Water hyacinth, *Biological wastewater treatment, *Industrial wastewater, Malaysia, Rubber industry, Palm oil mill effluent, Wastewater treatment, Wastewater lagoons.

In Malaysia lagoon systems have been successfully adopted by the natural rubber (NR) and oil palm industries to treat their effluents. The possibility of using Eichhornia crassipes (water hyacinth) in the lagoons to further improve the treatment system was investigated. Good removal of pollutants from the block rubber effluent was achieved using a hydraulic retention of 10 - 15 days. The resulting effluent discharge was of acceptable quality. Water hyacinth also markedly improved the quality of the effluent from the remilling rubber factories. Consequently propagation of water hyacinth in the lagoons has been recommended. Pilot plant trials with palm oil mill effluent (POME) have shown that water hyacinth can be successfully grown in anaerobically digested liquor removing 96% BOD, 87% COD, 96% suspended solids, 83% ammoniacal nitrogen and 97% oil and grease. It also removed more than 99% of the indicative bacteria such as coliforms, Escherichia coli and Streptococci. Under the Malaysian conditions, water hyacinth grew profusely yielding about 500 kg of dry matter per ha per day. The average dry weight was about 5.0% and it contained about 24% protein, 21% fiber and 14% ash. (Author's abstract)
W86-01200

SELECTIVE CULTIVATION OF EASILY HARVESTABLE ALGAE USING CROSSFLOW-MICROSCREENING,
Pretoria Univ. (South Africa). Dept. of Water Utilisation Engineering.
W. A. Pretorius, and L. C. Hensman.
Water Science and Technology, Vol. 17, No. 4/5, p 791-802, 1985. 14 Fig, 1 Tab, 15 Ref.

Descriptors: *Biological wastewater treatment, *Algae, *Crossflow-microscreening, Biomass, Stigeoclonium, Wastewater treatment, Algal harvesting.

The implementation of algal systems as a viable wastewater treatment option has been seriously limited by the availability of cost effective techniques for removing algae from the effluent stream. In this study, the problem of biomass separation was overcome by the selective cultivation of algae species which could be removed effectively by simple screening. The selection of desired species was achieved by a combination of short hydraulic space time and various size microscreens operating as algae selectors on the effluent stream. A high rate algae growth system, in which the mean cell residence time and hydraulic space time could be manipulated independently, was developed. With humus tank effluent as feedstock, a hydraulic space time of 10 hours and a 200 micro-m opening size crossflow-microscreen, the filamentous green algae, Stigeoclonium, became the dominant species. This selected culture could be readily maintained at any predetermined concentration in the system with less than 20 mg/l suspended solids in the effluent. The biomass produced was exceptionally easy to harvest. (Author's abstract)
W86-01201

WASTE WATER RECYCLING BY DUCKWEED FOR PROTEIN PRODUCTION AND EFFLUENT RENOVATION,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
G. Oron, L. R. Wildschut, and D. Porath.
Water Science and Technology, Vol. 17, No. 4/5, p 803-817, 1985. 6 Fig, 4 Tab, 31 Ref.

Descriptors: *Wastewater renovation, *Duckweed, *Biological wastewater treatment, Water reuse, Aquaculture, Wastewater ponds, Biomass production, Arid areas, Evaporation.

The success of a wastewater recycling system ultimately depends upon the quality of the renovated effluent, mainly for irrigation in dry areas, and on the quality and quantity of the additional by-prod-

ucts accepted. The simultaneous treatment of wastewater and the production of duckweed in a pond system, as an alternative protein source, is an attractive proposition for solving the feed and water shortage problem in arid areas. Outdoor experiments conducted in mini-ponds showed that duckweed ponds may be highly competitive with existing secondary treatment methods. Duckweed systems for secondary wastewater treatment can be highly productive with a biomass yield of 8 to 15 g/sq m per day (dry weight) and crude protein content in the range of 30 to 45% of the dry weight. The ease of the duckweed harvesting makes the system even more economically attractive, and the amino acid composition of the duckweed makes it a good alternative protein source. The removal efficiency of the major pollutants reaches 50 to 60%. The duckweed pond systems are superior to other wet free surface waste treatment methods in regards to water losses. At least 30% of water loss due to evaporation in other wet processes can be saved in duckweed ponds. In areas with limited water sources, this aspect is essential. (Moore-IVI)
W86-01202

POTENTIAL TREATMENT ALTERNATIVE FOR SWINE WASTEWATER IN THE TROPICS,
Hawaii Univ. at Manoa, Honolulu. Dept. of Agricultural Engineering.
P. Y. Yang, and S. Y. Nagano.
Water Science and Technology, Vol. 17, No. 4/5, p 819-831, 1985. 7 Fig, 9 Tab, 14 Ref. EPA grant R-808056.

Descriptors: *Animal wastes, *Tropical areas, *Biological wastewater treatment, Anaerobic digestion, Algal biomass raceway, Methane, Wastewater management, Energy production.

Development of a low-cost and effective swine waste management system in the tropics is the main objective of this study. Because of the appropriate temperature environment and abundance of sunlight, an integration of an anaerobic digestion and an algal biomass process was selected and investigated. A pilot plant integrating a 20 cu m anaerobic digester with sludge recycling and a 120 cu m algal-biomass raceway were installed and evaluated. Maximum gas production rate of 1.527 liter/liter/day (69% methane content) can be achieved by the total volatile solids (TVS) loading rate of 4.23 gram/liter/day. A sludge production rate of 0.82-2.62 g total solids/liter is obtained from a TVS loading rate of 0.76-4.23 g TVS/liter/day. Critical solids retention time for maximum gas production rate is 2.67. For the algal biomass raceway, a loading rate of 0.097 g soluble COD/liter/day or 0.017 g NH4-N/liter/day would achieve soluble COD and NH4-N removal efficiencies of 94.44% and 98.42%, respectively. Combining the previous analysis of energy input and land requirement for an algal biomass raceway and mass balance of energy production and utilization, integrating the energy production (anaerobic digestion) and energy utilization (dehydration of digested sludge and power requirement of raceway) provides a great potential for a swine wastewater treatment in the tropics. (Author's abstract)
W86-01203

HAZARDOUS SUBSTANCES IN WASTE WATER,
Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).
A. B. van Luin, and W. van Starkenburg.
Water Science and Technology, Vol. 17, No. 6/7, p 843-853, 1985. 12 Tab, 8 Ref.

Descriptors: *Wastewater, *Effluent, *Sludge, *Hazardous substances, Hydrocarbons, Industrial wastewater, Municipal wastewater, Volatile compounds, Chlorinated hydrocarbons, Aromatic compounds, Water pollution sources, Wastewater treatment.

The influent, effluent and sludge of six municipal wastewater treatment plants and wastewater from 59 industries were sampled and analyzed for hazardous substances. Volatile chlorinated hydrocarbons in sewage seem to originate mostly from industrial emissions. The amount of the emissions can fluctuate very strongly especially for dichloromethane and 1,2-dichloroethane. Chlorophenols, hexachlorocyclohexane, polychlorinated biphenyls and polycyclic aromatic hydrocarbons are always present at a low basic level in municipal wastewater and in many industrial wastewater streams. In addition to point sources there are also diffuse sources like deposition from the air and road traffic which are responsible for extra pollution of sewage. Volatile chlorinated hydrocarbons in sewage originate mainly from industrial discharges. Chlorophenols, hexachlorocyclohexane, polychlorinated biphenyls and polycyclic aromatic hydrocarbons appear to be present at a low and constant background in municipal sewage and in mainly industrial waste waters. The removal in the municipal treatment plants amounts to: volatile chlorinated hydrocarbons 50-90%; hexachlorobenzene 95%; hexachlorocyclophexanes 40-65%; chlorophenols 20-40%; PCB about 90%; PAH 85-95%. (Moore-IVI)
W86-01225

STABILIZATION OF ORGANIC CARBON AND NITROGEN IN CONSOLIDATING BENTHAL DEPOSITS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
C. W. Bryant, Jr, and L. G. Rich.
Water Science and Technology, Vol. 17, No. 6/7, p 929-940, 1985. 5 Fig, 4 Tab, 27 Ref.

Descriptors: *Organic carbon, *Nitrogen, *Stabilization, *Benthal deposits, Mathematical models, Simulation, Biodegradation, Activated sludge, Volatile compounds, Organic loading, Wastewater lagoons.

The objective of this research was to develop and validate a predictive model of the benthal stabilization of organic carbon and nitrogen in deposits of waste activated sludge solids formed at the bottom of an aerated water column, under conditions of continual deposition. A benthal model was developed from a one-dimensional, generalized transport equation and a set of first-order biological reactions. For model verification, depth profiles of the major interstitial carbon and nitrogen components were measured from a set of deposits formed in the laboratory at 20 C and a controlled loading rate. The observed sequence of volatile acid utilization in each benthal deposits was that which would be predicted by the Gibbs free energies of the individual degradation reactions and would be controlled by the reduction in interstitial hydrogen partial pressure with time. Biodegradable solids were solubilized rapidly during the first three weeks of benthal retention, but subsequent solubilization occurred much more slowly. The benthal simulation effectively predicted the dynamics of consolidating, organic deposits. Simulation of organic loading rates up to 250 g biodegradable volatile suspended solids/(sq m day) indicated that the stabilization capacity of benthal deposits was far above average the range of organic loading rates currently used in lagoon design. (Author's abstract)
W86-01232

ORGANIC REMOVAL MECHANISMS IN BIOPHYSICAL TREATMENT SYSTEMS,
Utah Univ., Salt Lake City. Dept. of Civil Engineering.
J. R. Schultz, and T. M. Keinath.
Water Science and Technology, Vol. 17, No. 6/7, p 1043-1054, 1985. 8 Fig, 1 Tab, 27 Ref.

Descriptors: *Biophysical treatment, *Phenols, *Organic compounds, Biodegradation, Bioregeneration, Adsorption, Activated carbon, Desorption, Wastewater treatment.

An experimental program was conducted to evaluate the significance of enhanced biodegradation, bioregeneration, and metabolic end product (MEP) adsorption in a bench-scale biophysical reactor using phenol as the substrate. Radiotracer methods and a desorption-extraction procedure that measures the amount of adsorbed phenol were used to discriminate between the various mechanisms. The results showed the major benefit of powdere vated carbon (PAC) addition under stead conditions to be MEP adsorption. Furthe adsorption reversibility was established as th trolling mechanism for bioregeneration. Rev adsorbed phenol could be desorbed to rege the PAC, but irreversibly MEP could not. therefore, acts as a storage reservoir during loads via an adsorption-desorption sequence thor's abstract)
W86-01240

OZONATION OF NON-IONIC SURFACT IN AQUEOUS SOLUTIONS,
Technion - Israel Inst. of Tech., Haifa. En mental and Water Resources Engineering.
For primary bibliographic entry see Field 5F
W86-01242

INFLUENCE OF BUBBLE SIZES ON O SOLUBILITY UTILIZATION AND DISI TION,
University of Petroleum and Minerals, D (Saudi Arabia). Dept. of Civil Engineering.
M. Ahmad, and S. Farooq.
Water Science and Technology, Vol. 17, N p 1081-1090, 1985. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Bubble size, *Ozone, *Disinf *Solubility, Microorganisms, Effluents, Ozo Wastewater treatment, Bacteria.

A disinfection study was carried out wi natural bacterial population of a secondary wastewater effluent in a continuous flow employing different sizes of ozone bubbles termine their effects on solubility of ozo utilization and inactivation of microorganism bubble sizes were varied by changing the po of the diffusers and ozone flow rates throu ozone contactor. Natural bacterial popu (standard plate counts) present in the sec wastewater effluent was enumerated befo after ozonation. The concentration of ozone aqueous phase increases with a decrease in t of the ozone bubble for a given gas flow provided the ozone concentration remains co in the gas phase. The amount of ozone utili wastewater decreases proportionally with t of the ozone bubbles for the same gas flow ra for the same level of disinfection. For a giv flow rate and ozone residual, the degree of vation of microorganisms increases as the ozone bubbles decreases. (Moore-IVI)
W86-01243

MANAGEMENT OF URBAN WASTE W PHYSICO-CHEMICAL TREATMENT TIONS: SERVOCONTROL OF REAGEN DITIONS AT THE QUIBERON SEW TREATMENT PLANT, FRANCE,
Laboratoire Central des Ponts et Chaussees guenais (France).
P. Marchandise, J. P. Legendre, D. Delacroi
J. L. Rivoal.
Water Science and Technology, Vol. 17, No p 1103-1112, 1985. 9 Fig, 2 Tab, 2 Ref.

Descriptors: *Wastewater treatment, *Tur *Automation, Physico-chemical treatment, control, Reagents, Quiberon, France.

The physico-chemical treatment of sewage for the use of quantities of reagents commen with the pollution to be eliminated. The us servocontrol makes it possible to add reage cording to pollutant content and to achi degree of pollution control chosen in adv Tests were carried out to determine turb COD-suspended matter relations in waste samples, and flocculation tests were used to mine treatment effectiveness curves for chlorosulfate. In this system, turbidity is co ously measured, using the Monitek turbidi The voltage delivered by the turbidimeter is grated by a logarithmic amplifier in accor with the effectiveness curve chosen and mult by the flowrate information; this controls the chlorosulfate metering pump. The installati the servocontrol module at the treatment pl

rance, for the 1983 tourist season pro-
pportunity for a full-scale test of the
s of the system. The reliability of the
demonstrated. For equivalent treat-
s 40,000 population-equivalents plant,
nt was amortized in one season's oper-
e-IVI)

G OF THE COAGULATION-AD-
PROCESS IN TREATMENT SYS-

chnical Univ. (Poland). Inst. of Envi-
tection Engineering.
bibliographic entry see Field 5F.

N AND ANALYSIS OF URBAN
TA IN FINLAND,
ard of Waters, Helsinki (Finland).
search Office.
n.
e and Technology, Vol. 17, No. 6/7,
985. 12 Tab, 9 Ref.

Urban runoff, *Pollution load, *Fin-
ation, Hydrology, Nutrients, Organic
g, Storm wastewater.

three-year urban hydrology program
ut in Finland. Data were collected
on the quantity and quality of pre-
runoff water at seven urban test
uring rainfall events, on the average,
of surfaces generating direct runoff
ccount for 50-80% of the proportion
ces in the residential catchments, and
the city centers. Under Finnish
pollutant loads discharged to recipi-
reated runoff waters are relatively
parison to those of purified waste
ing organic matter and nutrients.
ires in the Finnish sewage works
focused on other factors, such as
effectiveness of the existing waste
t plants, and decreasing the amount
ows to sewer networks. (Author's

ION, MINERALIZATION AND
N OF SLUDGE IN A SEWER-
A CASE STUDY,
Bos, Deventer (Netherlands).
rn-Roozemond.
and Technology, Vol. 17, No. 6/7,
5. 7 Fig, 3 Tab, 1 Ref.

edimentation, *Mineralization, *Re-
ewer systems, Combined sewer
anic matter, Temperature effects,
al variation.

mbined sewerage systems allows a
y of overflows, but it is difficult to
lution load from these sewer over-
y. Sedimentation and mineraliza-
ge system together with resuspen-
matter, which often becomes evi-
h phenomena. Quantitative infor-
ined on the processes of sedimen-
ation and resuspension of organic
ined sewerage system by means of
s of dry and wet weather data on
The effects of temperature and
ttent dry weather periods on daily
ere also evaluated. For the sewer-
tigated it was found in summer 5-
D produced is mineralized in the
ching the sewage treatment plant.
mineralization of organic matter
aneously. Models predicted that a
tion was attained after 5-7 days in
7-11 days in the winter. Due to
der dry weather conditions up to
organic load produced may be
vers as resuspendable deposits; in
ntage may even amount to 20-
low mineralization. These conclu-
id for the sewerage system stud-

W86-01255

POSSIBILITIES FOR USE OF LOWER GREEN AND BLUE-GREEN ALGAE IN THE ANIMAL FARMS WASTE WATER TREATMENT IN BULGARIA (V'ZMOZHNOSTI ZA IZPOLZVANETO NA NISSHI ZELENI I SINO-ZELENI VODORASLI V PRECHISTVATELNIYA PROTSES NA OTPAD'CHNITE VODI OT ZHIVOTNOV'DNITE KOMPLEKSI V B'LGARIYA),
K. M. Benderliev.
Hydrobiology, Vol. 23, p 9-14, December, 1984. 1 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Bulgaria, *Algae, *Cyanophyta, *Animal wastes, Feedlot wastes, Proteins, Water treatment, Fish ponds.

On the basis of original and reference data the possibilities for the use of green and blue-green algae in waste water purification in the Bulgarian climatic, demographic and economic conditions are pointed out and their economic effectivity is evaluated. The construction of aerobic algal oxidative pools either followed by, or not followed by, fish pools is recommended. Both should not be considered as water cleaning devices, but rather as protein recycling devices. For the time being, the construction of intensive algal ponds is not recommended. (Author's abstract)
W86-01259

FACTORS INFLUENCING THE OZONE INACTIVATION OF ENTERIC VIRUSES IN EFFLUENT,
Stanford Univ., CA. Dept. of Medical Microbiology.
M. S. Harakeh, and M. Butler.
Ozone: Science and Engineering, Vol. 6, No. 4, p 235-243, 1984. 9 Fig, 25 Ref.

Descriptors: *Ozonation, *Wastewater treatment, *Viruses, *Enteroviruses, *Disinfection, Water chemistry, Water treatment, Ozone, Ultrasonic treatment, Hydrogen ion concentration, Bicarbonate, Sodium bicarbonate, Hydroxide, Microorganisms.

Studies on ozonation of effluent for inactivation of viruses are limited and little is known about the range of conditions which influence the efficacy of ozone; the published work has been restricted to only a few enteroviruses. In experiments with the enteroviruses, polio type 1 (LSc 2ab), coxsackie B5 and echo 1, human rotavirus, simian rotavirus SA11, and f2 coliphage, inactivation kinetics with continuously applied ozone were approximately exponential with respect to time and concentration. The most resistant of the tested viruses was human rotavirus and the most sensitive was f2 coliphage. The disinfectant was most reactive at low pH. Viral sensitivity was increased ten-fold in the presence of 0.5M sodium bicarbonate which supports the hypothesis that it was molecular O3 that was the most active molecule and not the OH radical. Neither temperature, the presence of added peptone nor suspended solids greatly influenced inactivation, but ultrasonic treatment did, whether applied before or during ozonation. It has been postulated that when ozone hydrolyzes in water, about half of it will be converted to OH radicals, the most reactive oxidant known, with the rate of the hydrolysis dependent on the concentration of ozone, the pH, and the concentration of carbonate and bicarbonate ions. Hydrolysis is accelerated by raising the pH since the formation of the OH radical is favored at alkaline pH values but is inhibited by carbonate/bicarbonate which scavenge the radical in some way which is yet to be fully elucidated. The mechanism of inactivation by ozone is little understood; whether or not all viruses would be inactivated in a similar way remains to be determined, but it is very likely that even amongst the robust enteric viruses differences would be observed, although in practice these may not be relevant. (Collier-IVI)
W86-01268

HIGH TEMPERATURE TREATMENT OF TRINITROTOLUENE (TNT) AND CYCLOTRIMETHYLENE-TRINITRAMINE (RDX) WITH OZONE AND ULTRASOUND,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
R. A. Sierka.
Ozone: Science and Engineering, Vol. 6, No. 4, p 275-290, 1984. 2 Fig, 8 Tab, 14 Ref.

Descriptors: *Trinitrotoluene, *Wastewater treatment, *Water temperature, *Ozone, *Ultrasound, *Cyclotrimethylene-Trinitramine, Water treatment, Munitions industry, Industrial wastewater.

Treatment of synthetically prepared aqueous solutions of trinitrotoluene (TNT) and cyclotrimethylene-trinitramine (RDX) in the weight ratio 70%/30%, representing a typical munitions wastewater, was researched with a combination of ozonation and ultrasound. A parametric study investigated the relationship among the variables: (1) initial solution pH (5.84 to 10.0); (2) ultrasound power level (5 to 50 watts at 852.0 to 863.0 kHz); (3) ultrasound frequency level (60.6 to 1,007.0 kHz); (4) solution concentration (70/30 mg/l TNT/RDX solutions volumetrically diluted with distilled water in the ratios 1/0, 1/3); (5) reaction temperature (25 to 59 C). Removal rates of both TNT and TOC increased directly with increases in reaction temperature and initial solution pH. Likewise, increased sound power level produced enhanced system kinetic responses; however, these were attributed to reaction mass temperature increases. Ultrasound was found to inhibit reaction kinetics at high temperatures and pH because it promoted radical-radical extinguishment reaction. (Author's abstract)
W86-01271

APPLICATION OF ACUTE BIOASSAYS IN EVALUATING THE TREATMENT OF COAL LIQUEFACTION WASTEWATERS,
Department of Energy, Pittsburgh, PA. Pittsburgh Energy Technology Center.
T. J. Feeley, III, and C. J. Drummond.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, p 249-257, August, 1985. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Bioassays, *Toxicity, *Coal liquefaction wastewater, *Wastewater treatment, Evaluation, Gas stripping, Ammonia, Biochemical oxygen demand, Solvent extract, Toxicity, Oxidation.

Acute bioassays were performed on untreated coal liquefaction process wastewater and the wastewater following a series of treatment steps to determine the applicability of acute toxicity tests in evaluating the effectiveness of an integrated wastewater treatment strategy and selected treatment unit operations in reducing the contaminants present in the wastewater. The first step of the integrated treatment train, dissolved gas stripping, was responsible for a significant reduction in the total ammonia present in the wastewater. The largest reductions in acute toxicity were recorded after solvent extraction of the wastewater and after biochemical oxidation. The overall decrease in acute toxicity was due to significant reductions in both the inorganic and the organic contaminants present in the untreated wastewater, although the organics, specifically phenols, may play a more dominant role. Dissolved gas stripping and wet air oxidation were each performed on the untreated wastewater. Dissolved gas stripping removed the bulk of the total ammonia and sulfide from the wastewater but had little impact on the organic components and resulted in a 48 hr EC50 of only 0.12%. Wet air oxidation, on the other hand, appreciably reduced phenols, TOC, and BOD. The 48-hr EC50 of the wet air oxidized effluent was only 0.34% and probably reflects the high total ammonia remaining in the wastewater. The relatively small reductions in acute toxicity recorded after either of these two unit operations emphasize the importance of an integrated treatment program that removes both the inorganic and the organic contaminants from the wastewater. (Baker-IVI)
W86-01284

COUNTY RESTORES GROUNDWATER AQUIFER,

Fresno County Public Works Dept., CA.
For primary bibliographic entry see Field 5G.
W86-01314

5E. Ultimate Disposal Of Wastes

MULTI-OBJECTIVE DECISION-MAKING IN WASTE DISPOSAL PLANNING,
Oak Ridge National Lab., TN.
R. D. Perlack, and C. E. Willis.
Journal of Environmental Engineering, Vol. 111, No. 3, p 373-385, June, 1985. 1 Fig, 2 Tab, 17 Ref, 1 Append.

Descriptors: *Decision making, *Planning, *Sludge disposal, Waste disposal, Incineration, Land disposal, Ocean dumping, Economic aspects, Environmental effects, Cluster analysis, Multi-objective planning.

Ocean disposal is the present mode of disposal of the Metropolitan Boston (Massachusetts) sewage sludge; incineration and land application are alternatives being considered. A multiple objective programming model of the Boston sludge disposal problem was formulated in which the objectives of net economic benefits, environmental impact, and variability of impacts were included. A generating technique is used to solve for the noninferior solutions and cluster analysis is applied to reduce redundancy among generated solutions. The end result of this analysis is an array of possible solutions to the disposal problem, none of which are unambiguously superior. On the basis of cost, the ocean disposal solutions are clearly superior, while the solutions involving multiple disposal modes are the most expensive. Agricultural land application is somewhere in between. The reverse is true for the environmental impact objective, with land application again occupying the middle ground. An array of results such as this is likely to be more valuable to decision-makers than requiring them to articulate their conception of the social preference function (in advance of knowledge of the complete solution space), and then presenting them with a single optimum solution. This technique provides the maximum quantity of information to the decision-maker. (Moore-IVI)
W86-01044

CONTROLLING METAL UPTAKE FROM HEAT-TREATED SLUDGE APPLIED TO GRASSLANDS,
Port Elizabeth City Engineer's Dept. (South Africa).
J. W. Vail, and D. G. Devey.
Water Science and Technology, Vol. 17, No. 4/5, p 599-610, 1985. 6 Tab, 23 Ref.

Descriptors: *Metals, *Grasslands, *Sludge disposal, *Land disposal, Zinc, Nickel, Lead, Chromium, Pastures, Turf, South Africa, Standards.

A Zimpro heat-treated sewage sludge containing high levels of zinc, nickel, lead and chromium was successfully used to establish high-grade pastures and turf on two different coastal soils in South Africa, using guidelines and developed in the United Kingdom to control the rate of application. The properties and composition of the sludge and soils are described and levels of metals in the grass are reported. The rates of application suggested by the guidelines were effective in preventing excessive metal uptake. The results obtained are discussed in relation to tentative guidelines for controlling sewage sludge applications to land in South Africa. (Author's abstract)
W86-01185

STRUCTURAL FEATURES OF THE GREY-BROWNISH BLACK SANDY SOILS OF APSHERON AND THEIR ALTERATION FOLLOWING APPLICATION OF WATER PIPE SLUDGE FROM KUZINSK (MIKROMORFOLOGICHESKIE OSOBENNOSTI SEROBURYKH PESCHANYKH POCHV APSHERONA I IKH IZMENENIE PRI VNESENII KURINSKOGO VODOPROVODNOGO OSADKA),
I. Sh. Iskenderon, and Sh. M. Shirinova.
Izvestiya Akademii Nauk Azerbaydzhanskoy SSR Seriya Biologicheskikh Nauk, No. 1, p 25-28, 1983. 1 Fig, 15 Ref.

Descriptors: *Apsheron, *Azerbaijan S.S.R., *Soil types, *Kuzinsk, *Land application, *Sludge utilization, Sludge disposal, Sandy soils, Physicochemical characteristics, Geochemistry, Agriculture.

To improve the morphology of the sandy soils of Apsheron, Azerbaijan S.S.R., for the cultivation of vegetables, experimental studies with increasing doses of water pipe sludge applied per hectare of ground were carried out. The control soil samples featured a loose structure due to the presence of coarse mineral grains with rare carbonized plant inclusions. The mineral constituent was basically of calcitric and feldspar nature and had no colloidal membranes. Carbonates and organic substances were the basic binding constituent and the soil was lacking microaggregation. The sludge used in this study was dark grey, featured a tight structure with fine grain calcite and rare single pores. Application of 5, 10, and 30 T/Ha improved the microstructure of the sandy soil with increasing dosage of sludge generating ground plasma and soil aggregation. (Erdelyi-IVI)
W86-01256

5F. Water Treatment and Quality Alteration

ELIMINATION OF THE WATER POLLUTANT 2,4-D THROUGH ADSORPTION BY ALUMINUM OXIDE (ZUR ELIMINATION DES WASSERSCHADSTOFFES 2,4-D DURCH ADSORPTION AN ALUMINIUMOXID),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
H.-J. Walther, and B. Wiemer.
Acta Hydrochimica et Hydrobiologica, Vol. 11, No. 6, p 679-682, 1983. 2 Fig, 6 Ref.

Descriptors: *Water treatment, *Dichlorophenoxyacetate, *Aluminum oxide, *Adsorption, Pesticides, Humic acids, Drinking water, Hydrogen ion concentration, Sulfates, Phosphates, Dissociation.

The influence of humic acids on the adsorption of the pesticide 2,4-D (2,4-dichlorophenoxyacetic acid, sodium salt) by aluminum oxide in the treatment of drinking water was investigated. Organic and inorganic anions are adsorbed by aluminum oxide; among the latter in particular, sulfate ions and phosphate ions. The adsorption rate rises with declining pH values. The dissociation constant of 2,4-D (free acid) is 0.0023 and is of the general order of the dissociation constant of salicylic acid. (Moore-IVI)
W86-01005

FLOW UNDER TILT SURFACE FOR HIGH-RATE SETTLING,
Osaka Univ. (Japan). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W86-01040

EXPRESSION FOR DRINKING WATER SUPPLY STANDARDS,
Roorkee Univ. (India). Dept. of Civil Engineering.
D. S. Bhargave.
Journal of Environmental Engineering, Vol. 111, No. 3, p 304-316, June, 1985. 5 Fig, 2 Tab, 6 Ref, 1 Append.

Descriptors: *Drinking water, *Water quality standards, Water quality index, Model studies.

Various authorities and regulating agencies have set standards for deciding the suitability of a water for drinking purposes. These standards prescribe the permissible concentrations of quality variables. When some variables exceed the permissible levels, a decision for permitting further use of the water supply has to be based on the importance of those variables with exceeded concentrations. It is proposed that standards for a drinking water supply should be set through a single number representing the integrated effect of all the variables, due regard to the importance of each Such an integrated water quality index would help in decision making. Models and have been presented to evolve a WQI for water supplies. It is suggested that water WQI lower than 90 should not be permitt acceptable quality therefore, should be in range of the WQI. (Author's abstract)
W86-01041

REMOVAL OF PESTICIDES IN WAT MICROBIAL CELLS ADSORBED TO M TITE,
Queensland Univ., Brisbane (Australia). I Microbiology.
I. C. Mac Rae.
Water Research, Vol. 19, No. 7, p 825-830, Fig, 5 Tab, 24 Ref.

Descriptors: *Pesticides, *Microorganisms tion, *Magnetite, Lindane, 2,4-D, 2,4,5-T, Bacteria, Algae, Water treatment.

The removal of lindane (gamma-iso 1,2,3,4,5,6-hexachlorocyclohexane), 2,4-D dichlorophenoxyacetic acid) and 2,4,5-T trichlorophenoxyacetic acid) from water by bial cells immobilized on magnetite was The removal of lindane by cells of a ye bacteria and an alga ranged from 29 to bacterium, Rhodopseudomonas sphaeroi the highest sorption factor. No effect of p range pH 4.0-8.0 on sorption on lindane bacterium was found. Sorption of lindan sphaeroides reached equilibrium after 1 mi tion of lindane by live cells was not sign different from sorption by heat killed cel sorption stages employing fresh cells of R. oides on magnetite removed 90% of the from a water sample. Magnetite alone r 70% of the lindane in four stage process. I mixing period of 1 h, cells of Alcaligene phus removed 81% 2,4-D; 21.4% linda 12.6% of the 2,4,5-T added to water sam mixture of A. eutrophus and R. sphaeroi immobilized on magnetite removed 76.4% and 33% lindane from water samples co the two pesticides. (Author's abstract)
W86-01057

DISINFECTION OF CIRCULATING SYSTEMS BY ULTRAVIOLET LIGHT HALOGENATION,
Medical Coll. of Pennsylvania, Philadelphia
R. W. Gilpin, S. B. Dillon, P. Keyser, A. Androkites, and M. Berube.
Water Research, Vol. 19, No. 7, p 839-848, Fig, 10 Tab, 40 Ref.

Descriptors: *Disinfection, *Ultraviolet r *Chlorination, Water treatment, Cooling Whirlpools, Hot tubs, Legionella, Pseud Public health.

Continuous ultraviolet light (u.v.) and c disinfection of circulating water systems we uated. Direct comparisons of the biocidal e ness of u.v. light vs halogenation were test Legionella spp. and Pseudomonas aerugin cause of their association with the acqui overt clinical disease from water-containin ances. Findings indicated that six species gionella and P. aeruginosa were killed by a ate level of u.v. radiation. L. pneumoph other bacteria in a circulating water syste effectively killed by a biocidal u.v. light. H free chlorine levels needed to kill Legionell domonas, and Flavobacterium within 1 m found to be greater than 4 mg/ml. Data long-term field trial with u.v. light treat evaporative condensor water showed a sig reduction numbers of bacteria. Ultraviolet tion of hospital hydrotherapy whirlpoo firmed the utility of this mode of disinfectio circumstances where chlorination may not tical for medical reasons. These findings we firmed during investigations of halogen u.v.-treated public hot tub/whirlpools. Th tiveness of routine chemical disinfection trolling microbial flora in a cooling tower

he 2 month survey indicated that the bacteria, including Legionella, were by two biocides that were used. The made during this investigation sup- clusion that u.v. light disinfection of ing systems may be an appropriate r supplement to chemical biocides. tract)

F ACTIVATED CARBON ON THE OF COMBINED CHLORINE OLS,
at Urbana-Champaign. Dept. of Civil

s, R. A. Larson, and V. L. Snoeyink.
ch, Vol. 19, No. 7, p 909-915, 1985. 3
22 Ref. NSF grant CEE 81-10024.

*Activated carbon, *Monochlora- ls, Water treatment, Chlorinated chlorinated biphenyls, Prechlorina- water, Chlorination.

ce of ammonia, prechlorination in treatment results in contact of com- (monochloramine) with activated is used to remove organic com- vater. Monochloramine reacts very henolic compounds in aqueous solu- ow yields of chlorinated phenols. loramine reacts with phenols ad- ular activated carbon (GAC), how- oxidized products, principally hy- henyls, are formed. Some of the iphenyls are chlorinated (hydroxy- eir formation is particularly impor- their potential toxicity. Such com- or reaction products from chloro- y are also formed in small amounts ated phenols. Most of the monoch- phenolic compound reaction prod- roduced in similar reactions with dicating that similar reaction mech- ce on carbon's surface. No organic produced from the reaction of e with GAC alone. (Author's ab-

ATION CAN BOOST UTILITY CE,
., OH. Dept. of Mechanical and eering.
N. A. Damachi.
ing and Management, Vol. 132, June, 1985. 2 Fig, 2 Tab, 6 Ref.

Vater management, *Computers, sion making, Data processing, rinking water, Costs.

oaches available to most water iring computer services include: ter system with other muncipal uiring an independent computer to the water utilty for administra- nal functions. Some of the impor- faced by water utilities include or chemicals, labor and materials; costs; and stringent federal regu- lards. Another constraint is the personnel who posses adequate computers and their cost, capa- fits. While implementation of a based information system may rational changes, these changes ration and the flow of informa- d timely information retrieval at ent levels will enhance decision- in improved utilization of man- resources. Other potential bene- apabiliy to validate data to the different functions and produce h only valid information; and up porting system and statement of vements in the efficiency and ef- omer service to respond to que- s; an improved inventory moni- system; and facilitation of meet- latory requirements for drinking

W86-01084

STATE WATER SUPPLY MANAGEMENT IN NEW JERSEY,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 6C.
W86-01103

DETERGENTS FOR RESERVOIRS AND COLONY INCREASES IN POTABLE WATER (REINIGUNGSMITTEL FUR BEHALTER UND KOLONIEZAHL-ERHOHUNGEN IM TRINK-WASSER),
Bonn Univ. (Germany, F.R.). Hygiene Inst.
V. D. Schoenen, and C. D. Godde.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 18, No. 3, p 121-123, June, 1985. 5 Fig, 1 Tab, 1 Ref.

Descriptors: *Maintenance, *Reservoirs, *Bacteria, *Detergents, Reservoir operation, Drinking water.

As a rule drinking water reservoirs are cleaned in one year intervals for which purpose special detergents are frequently used. After such cleaning an increase of colony counts has been observed again and again. Up to now however it has not become clear whether the detergents have an influence on this result. In a laboratory examination 5 detergents were tested by cleaning cement mortar and high-grade steel plates. After the purification of the cement mortar plates 4 of the 5 materials examined showed an increase of colony counts and of TOC in the water. Examination of the high-grade steel plates did not show either an increase of colony counts or a charge of TOC. (Author's abstract)
W86-01140

DISINFECTION OF DRINKING WATER RICH IN BROMIDE WITH CHLORINE AND CHLORINE DIOXIDE, WHILE MINIMIZING THE FORMATION OF UNDESIRABLE BY-PRODUCTS,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
C. Rav-Acha, A. Serri, E. G. Choshen, and B. Limoni.
Water Science and Technology, Vol. 17, No. 4/5, p 611-621, 1985. 4 Fig, 4 Tab, 21 Ref.

Descriptors: *Drinking water, *Disinfection, *Bromides, *Chlorination, *Chlorine dioxide, Trihalomethanes, Chlorite, Halogenated hydrocarbons, Chemical reactions, Water treatment.

Although chlorine dioxide does not form trihalomethanes (THM) and produces very few non-volatile haloorganic materials in drinking water, intensive investigations bearing on the formation of chlorite by ClO2 disinfection reveal that the rate of chlorite formation reflects the rate of ClO2 consumption and as long as the amount of ClO2 applied is behind its demand, about 60% of the chlorine dioxide consumed is converted into chlorite. Mixtures of Cl2 and ClO2, which may successfully reduce the formation of haloorganic compounds, as well as of chlorite in the absence of bromide, fail to do this where water rich in bromide is concerned. As a result of bromide oxidation by chlorine, bromine is formed, which in turn reacts more intensively with organics than does chlorine and thus favors the formation of THM and other halogenated organic materials. This problem can, however, be circumvented if ClO2 is allowed to react in water with the organic precursors before chlorine is introduced. A pre-treatment with 1 ppm of ClO2 two hours before the application of 2 ppm Cl2, was found to reduce the formation of THM by 60% relative to its formation by chlorine alone, and the chlorite is reduced in this case by up to 90% relative to its formation by chlorine dioxide alone. This is of particular importance since it can solve some of the major problems bearing on the impact of disinfection upon the formation of undesirable by-products. (Author's abstract)
W86-01186

OCCURRENCE OF VIRUSES IN TREATED DRINKING WATER IN THE UNITED STATES,
Health Effects Research Lab., Cincinnati, OH.
E. W. Akin.
Water Science and Technology, Vol. 17, No. 4/5, p 689-700, 1985. 3 Tab, 30 Ref.

Descriptors: *Viruses, *Drinking water, Water treatment, Surface waters, Public health, Enteroviruses.

Health concerns regarding waterborne transmission of enteric viruses began to develop around 1940 in the U.S. with the isolation of poliovirus from human feces and sewage. The implication of these isolations for the transmission of viral disease through contaminated drinking water stimulated research on methodology for virus detection, recovery and assessment from water. Although virus methods research is still an important area of study, relatively sensitive procedures became available during the past decade for recovering many enteric virus types from large-volume samples of drinking water. Controversy surrounded many of the early reported isolations of viruses from treated drinking water using these procedures due to the suspicion of laboratory contamination. The occurrence of viruses in drinking water treated by currently accepted procedures has still not been proven by the U.S. experience although the likelihood may be gaining support. However, a virus survey of 54 water supplies and extensive studies of two water systems by the U.S. Environmental Protection Agency did not demonstrate viral contamination of treated water derived from surface sources. (Author's abstract)
W86-01193

OZONE ENHANCED BIOLOGICAL ACTIVATED CARBON FILTRATION AND ITS EFFECT ON ORGANIC MATTER REMOVAL, AND IN PARTICULAR ON AOC REDUCTION,
Studiesyndicaat voor Water, Antwerp (Belgium).
J. G. Janssens, J. Meheus, and J. Dirickx.
Water Science and Technology, Vol. 17, No. 6/7, p 1055-1068, 1985. 9 Fig, 7 Tab, 33 Ref.

Descriptors: *Activated carbon, *Filtration, *Ozonation, *Organic matter, Water treatment, Biodegradation, Organic compounds, Filtration, Biological treatment.

Ozonation of organic compounds in water usually produces oxygenated organic byproducts that are more readily biodegradable. Ozonation prior to granular activated carbon (GAC) filtration is evaluated in relation to organic matter removal, and in particular to AOC (assimilable organic carbon) reduction. Ozonation prior to GAC filtration resulted in a final water quality with generally a lower organic matter concentration. In terms of total organic carbon (TOC) removal, experimental results on pilot plant scale showed an increase of filter service time with about 60% to 65%. A dosage higher than 2 mg ozone/l had no additional effect. The extent to which this increase of service time was predominantly due to enhanced biological activity or to long term cumulative slow adsorption is not clear. An indicative economic analysis showed that the costs, as a result of ozonation, could not be covered by the cost-savings in reactivation of activated carbon. Ozonation caused a very significant increase of AOC. This was a function of the applied ozone dosage. Under equivalent conditions, GAC filtration of non-ozonated water gave the lowest AOC values in its effluent. First experimental results suggested a relation between ozonation and an early 'breakthrough' of AOC with GAC filters fed with ozonated water. If an AOC limit value is applied as a criterion for filter operating time, ozonation prior to GAC filtration would result in a significant shortening of the filter service time. (Moore-IVI)
W86-01241

OZONATION OF NON-IONIC SURFACTANTS IN AQUEOUS SOLUTIONS,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Narkis, B. Ben-David, and M. S. Rotel.
Water Science and Technology, Vol. 17, No. 6/7,

p 1069-1080, 1985. 14 Fig, 2 Tab, 24 Ref.

Descriptors: *Surfactants, *Ozonation, Wastewater treatment, Water treatment, Organic carbon, Polyethylene glycol, Oxidation, Biodegradation.

The effect of ozone on dilute aqueous solutions of a series of non-ionic surfactants of nonyl phenol ethoxylates, with n = 4 to 30 ethylene oxide groups, dinonyl phenol ethoxylate and a polyethylene glycol were investigated. Assuming ozone concentration in solution to remain constant throughout the ozonation, the experiments showed first-order reactions with respect to surfactant concentration, as measured by the Wickbold method, and also with respect to COD and TOC. A linear relationship was established between the first-order reaction rate constants, and between n, the average number of ethylene oxide groups in the ethoxylate chain of the nonyl-phenol ethoxylate series. The oxidation mechanism by ozone of non-ionic surfactant molecules is explained as mainly polyethoxylate chain's cleavage into shorter polyethylene glycols and to a smaller extent oxidation of the aromatic ring. High ozone doses do not convert the non-ionic surfactant completely to CO2 and H2O but smaller doses are sufficient to enhance biodegradation. (Author's abstract)
W86-01242

MODELLING OF THE COAGULATION-ADSORPTION PROCESS IN TREATMENT SYSTEMS,
Wroclaw Technical Univ. (Poland). Inst. of Environment Protection Engineering.
A. M. Dziubek, and A. L. Kowal.
Water Science and Technology, Vol. 17, No. 6/7, p 1113-1120, 1985. 2 Fig, 5 Ref.

Descriptors: *Mathematical models, *Coagulation, *Adsorption, Water treatment, Wastewater treatment, Organic matter, Chemical treatment.

Removal of organics in water or wastewater treatment systems is often described mathematically in the form of Langmuir and Freundlich adsorption isotherms. Using these equations, it is convenient to model, e.g., the removal of organic matter in the adsorption process on an activated carbon bed. In chemical treatment processes, organic substances are frequently removed from the water or wastewater under treatment via an adsorption on the precipitation products. In this paper presented is a generalized model of the equation of a multilayer adsorption isotherm, which describes total organic carbon removal from a solution during chemical treatment in an alkaline medium. The model also includes the nonremovable concentration of organics. (Author's abstract)
W86-01245

HEXAVALENT CHROMIUM REMOVAL FROM DRINKING WATER,
Centre de Recherche de Maisons-Laffitte (France).
J. M. Philipot, F. Chaffange, and J. Sibony.
Water Science and Technology, Vol. 17, No. 6/7, p 1121-1132, 1985. 2 Fig, 3 Tab, 4 Ref.

Descriptors: *Chromium, *Drinking water, *Water treatment, Water pollution sources, Air pollution, Metal-finishing industry, Groundwater pollution, Iron sulfate, Filtration, Automation, Meulan district, France.

A series of tests were performed with a view to solving the problem of chromium pollution in the Meulan district near Paris (France) due to the proximity of long-established metal-working plants. It was found that the accumulated pollution not only originated from the groundwater source but also from atmospheric contamination through fall-out from smoke and fumes issuing from local metal-works' stacks. Among the interesting features of this paper is the fact that, since the profound penetration by the pollutant affects potable feedstock, chromium removal studies have been made on potable water for the first time on record. Several methods are reviewed, among which the only economically feasible one appears to be the reduction of hexavalent chromium by a sufficient quantity of iron sulfate, the problem attached to iron-sulfate overdose being solved by the application of high-rate filtration on very fine sand. This arrests the fine precipitates and reduces the residual ferrous-iron by catalysis. Reliability of the treatment is ensured by a system of continuous metering that automatically controls reagent dosing. (Author's abstract)
W86-01246

HYGIENIC EVALUATION OF BENTONITIC CLAYS AND FILTRATING MATERIAL FROM AZERBAIJHAN DEPOSITS. 2ND COMMUNICATION: TOXICOLOGIC AND HYGIENIC STUDIES OF THE BENTONITIC CLAYS FROM AGBURUN DEPOSITS (GIGIENICHESKAYA OTSENKA BENTONITOVYKH GLINI FIL'TRUYUSHCHEGO MATERIALA AZERBAIDZHANDSKOGO MESTOROZHDENIYA),
V. Iu. Akhundov, K. F. Akhundov, A. P. Mamedova, S. M. Dzhafaron, and N. N. Naumova.
Izvestiya Akademii Nauk Azerbaydzhanskoy SSR Seriya Biologicheskikh Nauk, No. 2, p 115-123, 1983. 1 Fig, 10 Tab.

Descriptors: *Bentonite, *Clays, *Filtering, *Agburun, *Azerbaijhan S.S.R., *Water treatment, *Baku, *Kura River, Sand, Soil types, Water chemistry, Hardness, Salinity, Turbidity, Toxicity.

Due to the high turbidity of the waters of the Kura River a special method of their treatment has been outlined in Baku. To intensify the purification process the application of bentonites from various deposits of Azerbaijhan along with coagulants and a special flocculating agent has been recommended, while substituting the quartzite sand with natural deposits as filtrating material. The suspensions of bentonites from Agburun coagulate in the presendece of Ca(2+), Mg(2+), Na(+), K(+) cations of natural waters. Coagulation occurs within a wide range of pH, water hardness, salinity, and turbidity. The use of bentonites decreases by 1.5 or 2 times the consumption of coagulating agents. When used in combination with flocculating agents the need for aluminum sulfate decreases to zero while increasing the yield of the water purification plants and maintaining a high quality water supply. The optimal doses of Agburun bentonites range between 10-200 mg/l. Application of aluminum sulfate or flocculating agents in addition to bentonite permits a decrease of the latter by 30-50%. To develop a toxicologic profile of these substances for the recommendation of their use in the purification of natural waters for water supply acute, subacute and chronic toxicity experiments were carried out on rats. The physiological parameters under investigation including a swim test, a erythrocyte and leukocyte count and the determination of blood catalase and peroxidase. The acute experiment indicated that bentonite was not toxic in that its maximum tolerable concentration for the experimental animals was of 66 g/kg. No alterations in blood composition were seen and the swim test was no different from the control animals. The subacute experiment lasting 2 months with bentonite administered orally in 1.5, 7.5, and 15.0 mg/kg doses revealed no alterations in the explored functions of the rats. The chronic experiment (6 Mo) with animals treated with similar dose of bentonite showed no changes in the above parameters. Bentonite from Agburun was then officially approved as a substance to be used in water purification for water supply. (Erdelyi-IVI)
W86-01257

AMSTERDAM WATER SUPPLY,
Amsterdam Water Supply (Netherlands).
C. van der Veen.
Journal of the American Water Works Association, Vol. 77, No. 6, p 32-45, June, 1983. 10 Fig, 2 Tab.

Descriptors: *Amsterdam, *Netherlands, *Water supply, *History, *Rhine River, Recharge, Water conveyance, Dunes, Aquifers, Water pollution sources.

The drinking water supply and treatment system in Amsterdam, dating from the mid-1850s takes advantage of the new and the old. Supplies are drawn from natural catchment areas in sand dunes, from the Rhine River, and from surfa
well as from groundwater. The dune-w
is recharged with pretreated surface w
it is treated to potable quality for
Industrial water, which is not of drin
quality, is delivered separately to steel
mills, and an oil refinery. The pollu
Rhine River concerns water supplie
such as Amsterdam, that are located a
national boundaries from the sources o
The sources of water supply are ove
are the treatment processes and the
system that serve the capital city of
lands. (Author's abstract)
W86-01260

OLD AND THE NEW: BOGOTA'
PLANTS,
G. A. Meier.
Journal of the American Water Wor
tion, Vol. 17, No. 6, p 66-69, June,

Descriptors: *Water treatment facilitie
water, *Bogota, *Columbia, Developin
Filtration, Water supply development,

Despite import restrictions and a raw
ent that can vary sharply because of
rains, Bogota (Colombia) continues
water of low turbidity and of excelle
palatability. Bogota has been courageo
gressive with the construction of its ne
lion-dollar filtration plant, and the wa
fastidious when it comes to producing
water. Since Bogota's temperatures are
distribution pipes need not be buried d
homes are equipped with a cylindri
tank, which is primarily used in emer
tions. The Vitelma treatment plant w
tween 1933 and 1938, and although it
oldest plant, it remains impressive in its
maintenance and cathedral-like gra
Francisco Wiesner plant (El Sapo) wa
two years ago. El Sapo is more tech
advanced than Vitelma and incorporat
date amenities of a computer monito
and a central control board. It also has
lab furnished with the latest testing
Metering seems to have reached all
Bogota. Many hydrants are old and fau
soon need repair. The existing hydran
more blocks apart. (Baker-IVI)
W86-01262

DEVELOPING REGIONAL WATER
IN THE NETHERLANDS,
Texas Univ. at Austin.
D. J. Eaton.
Journal of the American Water Wor
tion, Vol. 77, No. 6, p 70-72, June, 19
Ref.

Descriptors: *Netherlands, *Water su
opment, *Planning, Water managemen
water, Water supply.

Over a 40 year period, beginning i
1920s, through a combination of self-h
but affordable water rates, and partial
subsidies to promote extension of water
regional utilities to remote areas, virtua
households in the Netherlands are no
with piped and treated drinking wate
regional differences exist among rural
nizations, the water services of Noo
Zuid-West Nederland, Midden-Nederla
Holland, Overijssel, and Groningen ar
on the common theme. Each is a se
entity managed by a board selected by
provincial governments. Each develop
impetus of local residents, assisted by a
ated by the national RID (Governmen
Water Supply). Each provides water in
and is able to take advantage of econom
for water extraction, treatment, and
Each has used part of its income to fina
ual extension of the distribution netwo
served rural areas. The pricing, pers
management policies have fostered loy
sense of participation among users, emp
local elected officials. The regional

ved more than their original aim of
vater supply to rural villages and farms.
facilitated general infrastructure im-
. They have promoted the moderniza-
r related industries. Each company has
dy employer of unskilled and semi-
or in regions where unemployment
been relatively high. (Baker-IVI)

**N OF TURBIDITY BY A COAL-
M FILTER,**
oll. of Technology, Potsdam, NY.
ivil and Environmental Engineering.
s, and R. L. Johnson.
he American Water Works Associa-
, No. 6, p 88-92, June, 1985. 12 Fig, 4

*Water treatment, *Turbidity, *Coal-
ilters, Filtration, Filters, Drinking
ogen ion concentration, Aluminum.

rbidity reduction using a coal-alumi-
s achieved at a pH of 5.0 for both a
natural raw water with a filtration
9 fps (10 m/hr). These conditions
ably generate approximately 200
aluminum ions by corrosion of the
nuous operation of a coal-aluminum
equire periodic replenishment of the
ticles. The laboratory data show that
could be expected to be between 10
is influent pH. In general, the capital
-aluminum filter plant will be signifi-
n a conventional or direct filtration
coagulation, flocculation, and sedi-
s are unnecessary. In addition, there
ificant reduction in the solids-han-
The coal-aluminum filter process
us monitoring of influent pH, possi-
n of an acid to depress influent raw
the desired level, replenishment of
inum, and the readjustment of the
the desired pH level. The turbidity
could be met by a coal-aluminum
raw water must be adjusted to the
-6 to achieve this result. The exact
required for the production of an
er quality vary with the raw water
Baker-IVI)

**CTIVATION OF BOTULINUM
N,**
e Fisheries Service, Milford, CT.

W. J. Blogoslawski, and J.

and Engineering, Vol. 6, No. 4, p
Fig, 1 Tab, 19 Ref.

Ozonation, *Toxins, *Botulinum
eatment, Drinking water, Ozone,
ridium.

one gas on botulinum toxin type E
ed. Under the conditions of this
velve minute exposure to 8.5 ppm
rate of 110 ml/minute, was ade-
ate completely 20000 MU/ml of
n a 65 ml volume. With 2000 MU/
than one minute was needed to
etely the toxin with an ozone con-
1 ppm. During the course of ex-
was observed that the conditions
exposure of the toxin to the gas
of inactivation at a constant flow
tions included excess foaming and
ch related to the contact time of
molecules. By controlling these
er, reproducible end points were
-IVI)

**OF POLLUTED SOURCE
OZONATION AND BIOLOGI-
D CARBON,**
ineering Inst. (China). Water Pol-
b.

B. Wang, J. Tian, and J. Yin.
Ozone: Science and Engineering, Vol. 6, No. 4, p 245-260, 1984. 17 Fig, 1 Tab, 17 Ref.

Descriptors: *Water treatment, *Ozonation, *Biological activated carbon, *Sand filtration, *Granular activated carbon, *China (Peoples Republic), *Harbin, *Heilongjiang, Activated carbon, Filtration, Turbidity, Color, Odor, Iron, Manganese, Organic substances, Chemical oxygen demand, Biological oxygen demand, Chromatograms, Ammonium, Nitrates, Water pollution.

In order to determine effective processes for purifying polluted source waters in Harbin City (Heilongjiang Province, China) various processes consisting of ozonation, sand filtration, and/or GAC filtration and adsorption, i.e., ozonation ('O3' Process), ozonation/sand filtration ('O3 + SF' Process), ozonation/biological activated carbon ('O3 + BAC' Process), ozonation/sand filtration/biological activated carbon ('O3 + SF + BAC' Proces), and granular activated carbon ('GAC' Process) were tested in an 8 cu m/d capacity pilot plant. In addition, a small plant of 500 L/d capacity was used to conduct comparative studies between the two processes 'GAC' and 'O3 + BAC', as well as two types of carbon. Of the processes tested, both the 'O3 + BAC' and 'O3 + SF + BAC' processes are most effective in removing various pollutants, including turbidity, color, odor, iron, manganese, organic substances measured as COD, BOC, chromatograms, and ammonium, nitrite, and nitrate ions. Specific efficiencies and mechanisms for removing such pollutants are described and discussed in detail. Based on the results of this study, two treatment flow sheets have been put forward for purifying polluted surface source water and polluted groundwater sources, respectively. (Author's abstract)
W86-01269

PRELIMINARY STUDY OF THE EFFICIENCY AND MECHANISM OF THM REMOVAL IN THE OZONATION AND BAC PROCESS,
Harbin Civil Engineering Inst. (China). Water Pollution Control Lab.
B. Wang, J. Yin, J. Tian, Q. Fan, and R. Liu.
Ozone: Science and Engineering, Vol. 6, No. 4, p 261-273, 1984. 8 Fig, 1 Tab, 16 Ref.

Descriptors: *Trihalomethanes, *Halogenated hydrocarbons, *Ozonation, *Water treatment, *Activated carbon, Chloroform, Water pollution sources, Chemical reactions, Anaerobic conditions, Adsorption.

A preliminary study on removing THMs from chlorinated water by ozonation ('O3' process) and granular activated carbon bed filtration and adsorption ('AC' process) was carried out. The chloroform content in chlorinated water was reduced to some extent by ozonation at low dosages, but then it increased steeply with time, and finally reached much higher than the original values. The GAC beds in both the 'AC' and 'O3 + AC' processes were found to be effective in removing chloroform by adsorption during their early operating period, corresponding to 4,000 - 5,000 bed volumes throughput, or one month duration for carbon X-11 and carbon ZJ-15 beds in the 'AC' process. With preozonation, i.e., the 'O3 + AC' process, the operating period with positive chloroform removal efficiencies was tripled. Nevertheless, the chloroform content in effluents from the GAC bed in both processes increased with operating time and throughput, and finally became much higher than the level in the influents. The phenomenon presumably was due to three mechanisms occurring in the carbon beds: 1) the biodegradation of complex chlorinated compounds into THMs: 2) the anaerobic digestion products can react with free chlorine in water to form THMs; 3) the desorption of THMs adsorbed on the carbon surfaces. In order to prevent the treated water from producing high concentrations of THMs, chlorination should be avoided before either the 'AC' or the 'O3 + AC' process. Home use carbon filters also are recommended to be used carefully and reasonably, for they can increase THM concentrations in effluents to levels much higher than those in the influents after a certain time of operation. (Author's abstract)

W86-01270

EFFECTS OF PH ON REMOVING LOW-LEVEL CHROMIUM CONTAMINATION IN GROUNDWATER,
Tennessee Technological Univ., Cookeville.
J. T. Mason, III, and C.-Y. P. Liau.
Journal of the Tennessee Academy of Science, Vol. 60, No. 3, p 77-79, July, 1985. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Chromium, *Hydrogen ion concentration, *Adsorption, Water treatment, Groundwater pollution, Adsorbents, Acidity, Flow rate.

Research on removal of low-level chromium contamination from samples of groundwater, along with included impurities, is described. A series of tests varying adsorbent amount, flow rate, and pH was conducted. In all cases the resin, Duolite ES-392, performed better than either of the carbons, Witco Witcarbon 950 or GECA Carborundum GAC 30, as adsorbents. The minimum adsorbent quantity (6 gm) and the medium flow rate (4.07635 ml/min) produced satisfactory chromium removal from pH 5 to 7 with the optimum pH somewhere closer to pH 5. The amount of chromium adsorbed increased from lower pH to near 5.6 and then decreaed rapidly with increasing pH values in the groundwater. The effects of flow rate demonstrate that velocity is a significant factor in treating to under 0.05 mg/l chromium. (Baker-IVI)
W86-01316

5G. Water Quality Control

RESTORATION OF A SMALL LAKE BY COMBINED MECHANICAL AND BIOLOGICAL METHODS,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
V. Kucklentz.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2314-2317, 1985. 1 Fig, 2 Ref.

Descriptors: *Biological control, *Lake restoration, *Unterfoehringer See, *Germany (Federal Republic), Rehabilitation, Macrophytes, Fish, Ecological effects, Chara, Chlorophyta, Recreation, Phytoplankton, Carp, Microcystis, Cyanophyta, Cyclotella, Asterionella.

Removal of sludge, mechanical removal of macrophytes, and introduction of fish were tried in a series of attempts to improve clarity and prevent overgrowth of a small (5.5 hectare) swimming lake, the Unterfoehringer See, West Germany. In 1972, water quality was bad, and Secchi disk transparency had decreased by 0.8 m. In 1975/76, sludge was dredged from the lake, but in summer 1977, Chara hispida covered nearly the entire lake, making fishing and swimming impossible. In autumn 1977, the lake was drained and Chara mechanically removed. To prevent redevelopment of the Chara, 1,000 grass-carp (Ctenopharyngdon idealla Val.) were introduced to the lake in April 1978. Fish were observed feeding on the filamentous algae and on the young leaf buds of Chara but during summer mass development of phytoplankton occurred. In August and September 1979, massive Cyclotella and Asterionella appeared, and in October of that year the lake was drained again. Total grass carp biomass had increased from 190 kg to at least 622 kg since introduction. Grass-carp (totalling 75 kg) were restocked, and in May 1981 silver carp (150, mean weight 190 g) were introduced. In April 1983 two specimens of each species of fish were obtained; the grass carp weighed 2,200 and 2,650 g and the silver carp weighed 700 g and 950 g. Plankton blooms have continued, and since 1981 blue-green algae have increased significantly. Microcystis has appeared recently for the first time. (Rochester-IVI)
W86-00946

WATER QUALITY CONTROL IN IMPOUNDMENTS,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia).

J. Chalupa, L. Fiala, J. Popovsky, V. Sladecek, and P. Vasata.
Acta Hydrochimica et Hydrobiologica, Vol. 13, No. 1, p 3-16, 1985. 3 Fig, 1 Tab, 39 Ref.

Descriptors: *Water quality control, *Reservoirs, Water pollution sources, Eutrophication, Multipurpose reservoirs, Sediments, Aquaculture, Network design, Sampling, Monitoring, Czechoslovakia.

This report on a seminar of the Water Research Institute in Prague deals with the methodological aspects of the measurement and evaluation of data for the water quality in impoundments in the CSSR mainly with respect to: the assessment of external causes, especially of anthropogenic influences in the catchment area, on the water quality (eutrophication, humic substances, trace elements), of the multi-purpose utilization of impoundments, the classification and development of the water quality in impoundments, the intensified utilization of impoundments as well as the influences of sediments and the effect of piscicultural measures on the water quality. The paper is subdivided into the following chapters: system of measurement network and analysis, stratification number of samples, number of the criteria to be investigated, extreme periods of discharge, multi-purpose utilization of impoundments, eutrophication, fish stocks. (Author's abstract)
W86-01006

GROUNDWATER POLLUTION HAZARD IN THE CAPE FLATS,
National Inst. for Water Research, Bellville (South Africa). Cape Regional Lab.
G. Tredoux.
Water Pollution Control, Vol. 83, No. 4, p 473-483, 1984. 11 Fig, 1 Tab, 10 Ref.

Descriptors: *Water quality control, *Monitoring, *Groundwater pollution, *Cape Flats, *South Africa, Water resources development, Groundwater, Water supply, Waste disposal.

The results of water quality monitoring in the Cape Flats are given and the implication of groundwater pollution are discussed, particularly in view of the proposed exploitation of the aquifer as a water source. The quality of the natural groundwater stored in the Cape Flats aquifer complies with the standards for domestic supplies, and the aquifer therefore has potential as a water supply source for Cape Town. The Cape Flats aquifer is unconfined, therefore it is vulnerable to pollution. In many places the groundwater level is close to the surface, which adds to the aquifer's susceptibility to pollution. Hazardous activities should be kept out of the area if the water source is to be protected. Pollution of the aquifer by leachates from landfills and sewage effluents has been proved by water quality monitoring. Waste disposal and sanitary landfilling should always be carried out with full precaution, even if pollution is not expected. The thickness of the unsaturated zone below a sanitary landfill is possibly the most important factor determining the groundwater pollution potential of the fill. Serious interaction takes place when the groundwater is in contact with the waste. The disposal of treated sewage effluent from an activated-sludge plant into the aquifer is not necessarily deleterious. Leachate from sludge drying beds should not be allowed to reach the aquifer. (Baker-IVI)
W86-01017

ESTIMATION OF THE LOADS OF SOME LIST I AND II SUBSTANCES TO UNITED KINGDOM TIDAL WATERS - A COMPARISON WITH PREVIOUS ESTIMATES,
Water Research Centre, Stevenage (England).
A. R. O'Donnell, and G. Mance.
Water Pollution Control, Vol. 83, No. 4, p 554-561, 1984. 1 Fig, 8 Tab, 7 Ref.

Descriptors: *Water quality control, *United Kingdom, *Pollution load, Wastewater discharge, Water pollution prevention, Rivers, Flow, Estimating, Coastal waters.

Current estimates of the loads of dangerous substances discharged to coastal waters in the United Kingdom are based on a comprehensive database including information from all significant land-based sources. The results are generally lower than previous estimates based on less comprehensive data. The loads discharged by rivers represent the largest percentage contribution to the overall inputs of these substances to coastal waters. Reduction of the uncertainty associated with quality data from sites reporting many results below the limit of detection, in combination with the utilization of flow data based on small sampling intervals, has resulted in a more realistic assessment of the loads contributed by rivers. For sewage discharges lacking quality data, estimated concentrations have been substituted. In general, the effluents, with measured water quality, serve large populations and the application of their quality data to other, smaller, discharges may bias these sewage load estimates. The loads from industrial discharges presented in this survey are undoubtedly overestimates, as a proportion of the loads have been evaluated using consented flows and concentrations. More realistic estimates of the loads of dangerous substances discharged to coastal waters can only be obtained from improved measurements of flow and water quality. (Baker-IVI)
W86-01025

STREAM DISSOLVED OXYGEN ANALYSIS AND CONTROL,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W86-01043

RISK ANALYSIS FOR SEISMIC DESIGN OF TAILINGS DAMS,
Consulting Geotechnial Engineer, Box 643, Indian Hills, Colo. 80454.
For primary bibliographic entry see Field 8D.
W86-01090

WATER QUALITY AND REGIONAL WATER SUPPLY PLANNING,
Corps of Engineers, San Francisco, CA. South Pacific Div.
For primary bibliographic entry see Field 4A.
W86-01101

RESTORATION OF LAKE VELUWE, THE NETHERLANDS, BY REDUCTION OF PHOSPHORUS LOADING AND FLUSHING,
Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).
S. H. Hosper.
Water Science and Technology, Vol. 17, No. 4/5, p 757-768, 1985. 8 Fig, 5 Tab, 6 Ref.

Descriptors: *Lake restoration, *Phosphorus, *Lake Veluwe, *Netherlands, *Flushing, Eutrophication, Oscillatoria, Algae, Species diversity, Chlorophyll a, Biomass, Transparency.

In the shallow and hypertrophic Lake Veluwe (Netherlands) the cycling of phosphorus between water and sediments was mainly determined by a continuous bloom of the blue-green alga Oscillatoria agardhii. For the restoring of water quality it was considered necessary to reduce the external P-loading as well as to suppress the release of phosphorus from the sediments. The P-loading of the lake decreased from approximately 3 to 1 g P/sq m a year in 1979. Additionally the lake has been flushed during winter periods with water low in phosphorus. Flushing was primarily aimed at interrupting the continuous algal bloom. After four winters of intensified flushing Oscillatoria still is the dominant alga but the diversity of species is increasing. In 1982 Oscillatoria disappeared for several months. The results show a sharp decline of summer values of total phosphorus from 0.40-0.60 mg/l to approximately 0.15 mg/l. In the trend of various parameters correlated with algal biomass a striking discrepancy is observed. Chlorophyll-a, ashfree-dryweight and particulate-phosphorus show a considerable and approximately similar decrease (50-60%). On the other hand the decrease of algal biomass in terms of freshweight (viz. biovolume of Oscillatoria) and reciprocal Secchi-disc values is relatively small (app ly 25%). Obviously the O. agardhii filam tain much less organic matter, chlorophyl phorus and nitrogen per unit of biovol implementation of remedial measures. Tr cy appears to be determined by nut volume of O. agardhii more than by chlo and ashfree dryweight. Intensified flushir continued for the next few years. (Aut stract)
W86-01198

WATER QUALITY CONTROL OF T DELSE MAAS BASIN, THE NETHE BY IRON DOSING,
Dune Water Works of The Hague (Net
A. C. Hoekstra, and K. D. Maiwald.
Water Science and Technology, Vol. 17, p 769-780, 1985. 7 Fig, 3 Ref.

Descriptors: *Water quality control, Maas Basin, *Netherlands, *Iron, Ph Mathematical models, Nutrients, Algal Eutrophication, Chlorophyll a, Orthoph

The Dune Water Works of The Hague lands) pumps yearly about 45 million water from the Andelse Maas Basin to t for infiltration purposes. The water in the Maas Basin in strongly influenced by th river. Phosphate concentrations are so l algal growth causes difficulties in filters a For phosphate reduction purposes, iron into the basin. Several limnological vari monitored based on weekly measurem mathematical model has been developed description of the eutrophication in the ba model is time and space dependent and one-dimensional dispersion-advection Two separate submodels are used, one simulation of flow conditions and one for nutrient kinetics. The ortho-phosphate red modelled as a first order process. The eut tion model has been calibrated, verified for a prediction of chlorophyll-a and ort phate concentrations for the case of the sh of the iron dosing installation. The dosing appears to be a very effective was for ph removal. Termination of the dosing wo unacceptable high phosphate and chlo concentrations. Present investigations are upon the minimization of the amount dosing. (Author's abstract)
W86-01199

AQUATIC HABITAT ANALYSIS AS A MENT OF WATER RESOURCES PLA AND MANAGEMENT,
Illinois Univ. at Urbana-Champaign. Dept. Engineering.
E. E. Herricks.
Water Science and Technology, Vol. 17, N p 879-890, 1985. 6 Fig, 3 Tab, 16 Ref.

Descriptors: *Aquatic habitats, *Enviro quality, Water quality, Water resources d ment, Habitats, Aquatic environment, Habit agement, Instream flow, Illinois.

With increased emphasis on environmental objectives in water resources planning and agement, past practices of simply cons water quality as the only environmental objective are inappropriate. Expanded en mental quality objectives include maintena high quality aquatic habitat. Water resour tems must provide both physical and ch conditions appropriate for the propagation maintenance of healthy diverse aquatic com ties. Managing water resources to provide quality habitat involves planning to meet water quality and water quantity objectives ing technology based water quality contro stream based water quality criteria can no supplemented by aquatic habitat managemen approach to aquatic habitat management is trated by use of the Incremental Methodo developed by the U.S. Fish and Wildlife Se The Incremental Methodology uses measur aquatic habitat to assess instream flows requir aquatic life. Thus the range of environmental

es in resources planning and manage-
anded by application of these methods
quatic habitat as well as water quality
t. Methods used to determine instream
for rivers in Illinois are reviewed, and
his information in developing regula-
g water extraction for off stream use
d. Aquatic habitat based management
provide workable methods to meet
nvironmental quality objectives in
rces planning and management. (Au-
ct)

G WATER QUALITY AND THE EF-
AGRICULTURAL BEST MANAGE-
ACTICES IN THE IOWA RIVER

chols and Co., Inc., Palo Alto, CA.
l, A. S. Donigian, Jr., and T. A.

e and Technology, Vol. 17, No. 6/7,
1985. 6 Fig, 5 Tab, 7 Ref. EPA
3-2895.

*Model studies, *Water quality con-
anagement practices, *Agriculture,
Basin, Hydrology, Nonpoint pollu-
Path of pollutants, Simulation, In-
rt, Transformation, Sediments.

e hydrology and water quality mod-
plied to the Iowa River Basin to
ffects of agricultural nonpoint pollu-
posed best management practices
nodel application combines detailed
gricultural runoff and soil processes,
lation of surface and subsurface pol-
rt to receiving water, with subse-
on of instream transport and trans-
e result is a comprehensive simula-
sin water quality. This was part of a
ich included application and evalua-
ydrological Simulation Program -
HSPF) to both the data-intensive
ek watershed and the Iowa River
le Reservoir. The methodology de-
ur Mile Creek was extrapolated to
Basin to demonstrate its applicabil-
nality on a large river basin. Many
er values from Four Mile Creek
irectly to the study area without
le other parameters were modified
able information and calibration.
sed to model the flow, sediment,
ty (specifically pesticides and nitro-
om large agricultural river basins.
f parameter values from nearby or
alibrated watersheds can be per-
reasonable degree of confidence.
libration effort, simulation of flow
he main stem of the Iowa River
in this study, in spite of problems
rainfall data and with modeling
ng of snowmelt runoff. Sediment
oor due to insufficient calibration,
model deficiencies. (Moore-IVI)

ALITY STANDARDS: THEIR
AND APPLICATION IN THE
OOM,

Centre, Stevenage (England).
. R. O'Donnell.
d Technology, Vol. 17, No. 6/7,
. 4 Fig, 2 Tab, 26 Ref.

ndards, *Water quality, *Marine
nited Kingdom, Water pollution
, Copper, Chromium, Lead,
senic, Coastal waters, Tempera-
ty.

European Communities Directive
f Dangerous Substances requires
o eliminate pollution by List I
reduce pollution by List II sub-
List II substances, individual
e required to specify limit values
ntal quality objective approach.
environmental quality standards

(EQSs) for coastal waters and the difficulties of using such standards for controlling industrial discharges are discussed. Attention is focused on the common List II substances (copper, chromium, lead, nickel, zinc and arsenic) and their effects on marine life. Marine toxicity data are largely limited to relatively short exposure periods under conditions of constant temperature, salinity, and concentration of test substance. Insufficient attention has been directed to investigating the significance of such environmental factors as salinity and temperature on the toxicity of the List II heavy metals. Field studies of the environmental impact of heavy metal discharges to coastal waters are required that adequately describe the spatial and temporal variations in water quality as well as biota. In practice the available toxicity data enable an initial assessment of the EQSs. Progressive extension of regulatory controls to all tidal discharges, with the phased implementation of Part II of the Control of Pollution Act means that these tentative EQSs will be judged against the real world by their use in licensing existing discharges. Implementation of these controls will undoubtedly increase the availability of field impact assessments enabling the EQSs to be reviewed and subsequently restated with increased confidence. (Moore-IVI)
W86-01252

EEC SHELLFISH DIRECTIVE IN WALES,
University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.
S. N. Young, and P. Wathern.
Water Science and Technology, Vol. 17, No. 6/7, p 1199-1209, 1985. 1 Fig, 5 Tab, 13 Ref.

Descriptors: *Wales, *Shellfish, *Water quality standards, Water pollution control, International agreements, United Kingdon, Standards, Monitoring, Public health.

This paper contains details of the procedures adopted by the UK Government in implementing the EEC shellfish directive and a review of the water quality monitoring programs used by the Welsh Water Authority with respect to these provisions. Six shellfish beds have been surveyed in detail by the Authority, but only one has been designated. This is the only shellfishery which meets the standards. Raising the remainder to the required standards would involve considerable capital expenditure, mainly for sewage treatment. The UK Government has precluded such expenditure. It has claimed that any public health measures inherent in the directive are covered adequately by current UK practice. This stance is questioned in the light of a recent viral study. This paper highlights the potential problems when there is conflict between international and national water quality priorities. (Author's abstract)
W86-01253

OPERATION AND EFFICIENCY OF AUTOMATICALLY OPERATING WEIR STRUCTURES - A CONTRIBUTION TO CLEANER WATERS,
Technische Univ. Braunschweig (Germany, F.R.). Leichtweiss-Inst. fuer Wasserbau und Grundbau.
For primary bibliographic entry see Field 4A.
W86-01254

COUNTY RESTORES GROUNDWATER AQUIFER,
Fresno County Public Works Dept., CA.
R. D. Welton.
Public Works, Vol. 116, No. 7, p 58-60, July, 1985. 3 Fig.

Descriptors: *Aquifers, *Groundwater pollution, *Water quality control, Water supply, Landfills, Percolation, Leakage, Water pollution sources.

The Southeast Regional Solid Waste Commission's Disposal Site is a 74 acre municipal landfill that has recently acquired statewide notoriety in California because it is suspected of degrading groundwater in its immediate vicinity. This degradation primarily involves volatile organics trichloroethylene and tetrachlorethylene. The landfill operated between 1970 and 1979 without any detected water problems. In 1979 the groundwater monitoring detected an increase in iron and manganese in two of the monitoring wells. On investigation, the landfill was found to be saturated in several areas. Three possible sources of the moisture were discovered: an agricultural irrigation pipeline was leaking; a small segment of the landfill had been completed and landscaping had been installed with a drip type irrigation system which was leaking; and the interim level grade of the landfill did not properly redirect rainfall runoff and percolation was a problem. Two treatment options, a granular carbon filtration system and an air stripping process were considered for the removal of volatile organic and inorganic contamination. Field testing of the air stripping method showed it effectively removed volatile organics by volatilization and oxidized iron and manganese. This aquifer restoration project supports the contention that groundwater restoration is expensive, even with the low cost air spraying process used. Considering the low level of contamination and the small area involved in this project, the near half million dollar expenditure thus far equals about 40 cents for every ton of buried waste in the landfill. Future continued operational and maintenance costs are expected to cause the total cost to eclipse this half-million dollar amount. When confronted with a moving plume of contamination, it may be more efficient to attack the problem with a staged construction contract immediately. Quickly pursuing a project may reduce costs overall. (Baker-IVI)
W86-01314

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ORGANIC POLLUTION; MANAGEMENT OF FRESH WATERS: INPUT OF SCIENTIFIC DATA INTO POLICY FORMULATION IN THE UNITED STATES,
College of New Rochelle, NY. School of Arts and Sciences.
M. M. Holland, and J. J. Balco.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2221-2225, 1985. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Resource management, *Policy making, *Environmental impact, *Water resources development, Resources development, Administrative agencies, Decision making, Administrative decisions.

Historically, there has been a strong federal role in the management of water resources in the United States. Prior to the 1970's water resource management decisions typically considered mainly economic factors; the agencies responsible for implementing programs (eg, US Army Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, and Tennessee Valley Authority) have been, and continue to be, largely civil-engineering, construction-oriented agencies. Since passage of the National Environmental Policy Act in 1969 as well as other environment protection legislation, emphasis in mangement decisions has shifted from economic benefits toward considerations of impacts of human activities on ecosystems. The institutional arrangements for water resource management decision-making in the United States are exceedingly complex, and scientific input is not necessarily the basis of policies. Two recent examples of scientific participation in the decision-making process governing management of US freshwater wetlands are: (1) the wetlands preservation program of The Nature Conservancy, a private group that acquires critically important wetland areas to ensure their preservation, and (2) a program sponsored by the US Department of Transportation Federal Highway Administration, in which scientists were asked to review a report on functional wetland assessment. A third way for scientists to have input in the decision-making process is through increasing public awareness, because Congressmen vote as their constituents tell them. In the future, three steps are necessary to increase the influence of scientists in the decision-making proc-

ess governing US fresh waters: (1) create standard methodologies for obtaining, presenting, and evaluating data; (2) develop policies that recognize that ecosystems are dynamic resources; and (3) improve communication between scientists and important groups of nonscientist, such as economists, the news media, personnel of regulatory agencies, and, especially, the average citizen. (Rochester-IVI)
W86-00933

MULTI-OBJECTIVE DECISION-MAKING IN WASTE DISPOSAL PLANNING,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5E.
W86-01044

COMPUTERIZATION CAN BOOST UTILITY PERFORMANCE,
Cincinnati Univ., OH. Dept. of Mechanical and Industrial Engineering.
For primary bibliographic entry see Field 5F.
W86-01084

PROBLEMS IN WATER RESOURCES UTILIZATION,
Asian Inst. of Tech., Bangkok (Thailand).
I. Fude.
Indian Journal of Power and River Valley Development, Vol. 33, No. 5/6, p 175-180 and 187, May-June, 1983.

Descriptors: *Water resources development, *Planning, Conservation, Economic aspects, Soil erosion, Water demand, Water quality, Hydroelectric plants, Technology transfer, Flood control, Agriculture.

In this era of scientific proliferation, startling new discoveries and inventions are being made in an unceasing stream, but the application of modern scientific discoveries and principles in water technology lags far behind. Areas in which attention is needed include: conservation of water supply; excesses in water resources planning; screening and review of water development plans; post-implementation cost accounting; financing water resource development; the need for reservoir storage space; soil erosion; energy and power surveys; underground hydroelectric powerplants; manpower planning; research and development; dissemination and exchange of information; standardization of measurement systems; the accumulation of useful experience; daily weather reports, flood control, agricultural production; and water quality. In water resources utilization, solutions can be found through the imagination, ingenuity and industry of the people and the transfer of technology and expertise. Care must be taken in the transplant of technique and methodology without adaptation or modification to suit or meet peculiar local or national requirements. (Moore-IVI)
W86-01206

MECHANISATION VS. MANUAL EXECUTION OF RIVER VALLEY PROJECTS IN MAHARASHTRA,
Bhatsa Project Circle, Thane (India).
V. R. Deuskar, and M. V. Bhave.
Indian Journal of Power and River Valley Development, Vol. 33, No. 9/10, p 330-342, September-October, 1983. 4 Fig, 5 Tab.

Descriptors: *Construction, *Mechanization, *Maharashtra, *India, Planning, Dams, Canals, Water resources development, Dams, Hydroelectric plants, Irrigation projects, Water supply.

The subject of mechanization vs. manual labor in river valley construction projects has been discussed in Maharashtra for the last two or three decades. The river valley projects may be irrigation, water supply, hydropower, or multipurpose plans. There appears to be no single answer to the the problem of choosing mechanization or manual labor, which would be applicable to all situations and all times. Each case is an individual by itself and a choice has to be made by those in charge after taking into account many factors such as site conditions, time available, machinery and equipment already in hand, the need regarding providing employment, possibility of repetitive use of machinery, ready availability of labor and others. In the long run the trend is toward mechanization, and India will also be caught up in this trend. In the near future the construction industry will have to gear up for gigantic projects, and mechanization for the critical elements of these will be inescapable in order to keep on construction schedules. (Baker-IVI)
W86-01215

TOMORROW'S TECHNOLOGY FOR TODAY'S PROBLEMS,
Wessex Water Authority, Bristol (England).
For primary bibliographic entry see Field 8A.
W86-01261

6B. Evaluation Process

INCREASE OF THE EFFECTIVENESS OF USING THE HYDROPOWER RESOURCES OF THE ENISEI RIVER,
G. S. Arsev'ev.
Hydrotechnical Construction, Vol. 18, No. 10, p 461-464, October, 1984. 1 Tab, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 4-6, October, 1984.

Descriptors: *Enisei River, *USSR, *Hydroelectric power, Water resources development, Economic evaluation, Efficiency, Runoff, Electrical networks, Water management, Interbasin transfers.

For hydropower stations with a different degree of regulation and located on rivers with an asynchronous runoff regime, when united into an integrated power grid, the most effective operating regime is a regime of compensating electric power regulation, as a result of which the effectiveness of using the hydropower resources and total firm output increase. The effect of asynchronous runoff and the effect of compensating regulation on the total firm output of hydrostations under combined operating conditions of existing and planned hydrostations in the lower Enisei basin (USSR) were investigated. Investigations were carried out by direct comparison of the variation of the runoff from different parts of the basin and determination of the correlations for a combined period of observations from the 1937-1938 to the 1975-1976 water management years. Calculations to establish the effect of asynchronism of the annual runoff on an increase of the total firm output of hydrostations both in the case of independent and compensating regulation were performed on the basis of using the equation of the variance of the total series composed as a result of adding individual n series. The results indicate that the onetime economic effect due to organizing and conducting interbasin compensating regulation at hydrostations in the lower Enisei basin can amount (at a cost of 176 rubles per 1 kW of installed capacity of a thermal power station and with consideration of construction of transmission lines) to about 160 million rubles. (Baker-IVI)
W86-00986

INVENTORYING GROUND WATER IN CRYSTALLINE ROCKS OF PIEDMONT REGION,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 2F.
W86-01104

WATER RESOURCES ENGINEERING EDUCATION,
Virginia Water Resources Research Center, Blacksburg.
W. R. Walker, and P. G. Bridgeman.
Journal of Water Resources Planning and Management, Vol. 111, No. 3, p 338-345, July, 1985. 12 Ref.

Descriptors: *Education, *Water resources engineering, Engineering, Social aspects, Political aspects, Economic aspects, Planning, Management.

Water resources engineering education n
the development of practioners who m
only technically proficient, but also c
managing engineering problems in a so
cal, and economic context. Professional
sources engineering requires the ability
nicate in interdisciplinary efforts, to p
information programs, and to factor
social input, as well as technical know
problem solving. Opportunities to impr
resources engineering education include
methods of evaluating students that incl
ments of communications skills; (2)
course requirements linking technical
science/humanities programs through
pointments, faculty exchanges, or socia
humanities courses tailor-made for the e
student; (3) a shift from traditional grad
ing to providing an opportunity for gr
search on open-ended problems typicall
water resources engineering; (4) nonopti
experience in the real world; and (5)
outside of the accreditation process to
program experimentation. Professional
ers can only benefit by such educationa
ments and should provide substantial ex
port for basic research evaluating engine
cation curricula, as well as support fo
volvement in curriculum development.
abstract)
W86-01107

**INVESTIGATION OF DAM SITES:
PRACTICES,**
National Hydroelectric Power Corp.
Delhi (India).
For primary bibliographic entry see Fiel
W86-01210

**LOW HEAD CANAL POWER DEVEL
IN PUNJAB,**
Thapar Coll. of Engineering, Patiala (Ind
P. V. Gupta, and M. S. Dua.
Indian Journal of Power and River Vall
opment, Vol. 33, No. 12, p 411-424,
1983. 3 Tab, 13 Ref.

Descriptors: *Canals, *Hydroelectric pla
head, *Punjab, *India, Construction,
Water resources development, Costs.

A state such as Punjab (India) should ta
tage of the operating experiences with
droelectric generating units gained in o
tries. The necessary technical knowhow
facturing capability apparently exists in P
such developments will be helpful in
exhaustible sources of energy such as co
A great deal of water flowing throug
canals could be put to work at relatively
to generate electricity. The cost of gener
from these small hydroelectric schemes
little more than generating costs fro
projects but is is definitely very much
thermal diesel generation costs. The m
ment in favor of small hydroelectric s
that these can start functioning in a per
years to 2 years with resources within
limits of the State. (Baker-IVI)
W86-01221

HYDROPOWER SCENARIO,
Uttar Pradesh Irrigation Dept., Lucknow
P. S. Nigam.
Indian Journal of Power and River Valle
opment, Vol. 33, No. 12, p 421-424, D
1983. 3 Ref.

Descriptors: *Water resources developm
droelectric plants, *Uttar Pradesh, *Indi
ning, Dam construction, Tunnels, Econ
pects, Multipurpose reservoirs, Irrigatio

The advantage of hydro power is that the
renewable and the production of power
consume the water. The main objection a
large hydro schemes has been the high
vestment involved in the beginning and
gestation required before the benefits
reaped. In India during 1981-82 the tota

ion was about 123 TWh of which the share
o was 40.3%, thermal 56.6%, nuclear 2.4%,
sel and gas turbine 0.7%. In Uttar Pradesh
end of 1968 percentage of hydro installation
out 52% of the total capacity. The pace of
ectric development slowed down after
spite of its intrinsic merits. The most im-
factor was a lack of financial resources.
al hydro potential in Uttar Pradesh is esti-
o be 13,000 MW of which only 1,200 MW
en commissioned so far. Having used only
he hydro potential in the State it is neces-
accelerate hydro power development by
ing an organization entirely devoted to
power and multipurpose projects and
eparate allocations for hydro power. It is
y to employ cheaper and expeditious
of construction for dams and tunnels even
y involve importing technology. Large
pose and hydroelectric projects should be
ed that interim partial benefits are derived
nomical manner. Mini hydro schemes on
irrigation canals can fill up the gaps in
elopment period projects. Research and
ent programs for unconventional renew-
ces of electricity should be accelerated.
I)
2

st Allocation, Cost Sharing, ng/Repayment

VATER SUPPLY MANAGEMENT IN RSEY,

ey Dept. of Environmental Protection, Div. of Water Resources.
le, Jr.
Water Resources Planning and Manage-
111, No. 3, p 284-292, July, 1985. 1 Fig,

s: *Water supply development, *Water
e, *New Jersey, Drought, Water pollu-
ndwater pollution, Management, Plan-
lations, Feasibility, Loans.

ersey, existing water supply problems
ater availability during droughts and
rgencies, contamination, especially of
ater, and institutional problems. A
curred in 1980, just as the new Water
ster Plan was completed; and a large
was approved, together with statutes
engthening the State's authority for
y management. As a consequence, the
very advanced water supplying plan-
tory and management program, which
th positive and negative incentives to
guidance. To date, the State has built
s only three water supply projects, and
government, none. Thus, the greater
development and of system rehabilita-
ed out by the 620 public water supply
he State (many of which are privately
w Jersey policy emphasizes manage-
problem-solving. Feasibility planning,
y regulatory requirements to provide
standard of service, encourages local
ow interest loans, rather than grants,
ncourage high priority programs such
work in contaminated well fields. (Au-
ct)

r Law and Institutions

IZATION: A DECADE POINTS TO NGE,

rities Association, London (England).

eering and Management, Vol. 132,
, June, 1985.

*Water management, *England,
tewater treatment, *Water treatment,
ion, Water conveyance, Manage-
ng, Organizations, Sludge disposal,

In 1974 the responsibilities of over 1500 organizations for water supply, wastewater collection and treatment, and rivers were assumed by just ten autonomous water authorities in England and Wales. Additional changes are now being made, aimed at streamlining the water industry through changes made in the structure of the water authorities themselves. Training within the industry is now the job of the Water Industry Training Association, a company operating on commercial lines. A new central body was also established. Recent reductions in capital expenditures in real terms has brought about a greater emphasis on project appraisal. The water industry's first priority is to ensure that supplies are not a source of infection from harmful organisms. This involves the protection of sources, the disinfection of water supplies, and the monitoring of water in distribution systems. Britain's Water Research Center is now paying more attention to sludge disposal as well as sludge treatment in response to advice from water authorities. In considering future policy for sludge dumping in the seas around England and Wales, the water industry is most concerned in understanding the contribution made by sewage sludge to total polluting loads. The choice of sludge disposal routes is essentially a question of balancing risk avoidance against cost reduction. (Baker-IVI)
W86-01086

DETERMINATION OF URBAN FLOOD DAMAGES,

Corps of Engineers, Baltimore, MD. Baltimore District.
S. J. Appelbaum.
Journal of Water Resources Planning and Management, Vol. 111, No. 3, p 269-283, July, 1985. 8 Tab, 13 Ref.

Descriptors: *Flood damage, *Urban areas, *Computers, Utilities, Transportation, Emergency services, Housing, Commercial establishments, Costs.

A new methodology and computer program, DAPROG 2, have been developed by the Baltimore District, Corps of Engineers to estimate urban flood damages. Stage-damage relationships are computered for individual residential and commercial properties. These individual relationships are the aggregated into composite stage-damage relationships for an entire reach. For residential properties, replacement values for the structure and contents are estimated and applied to depth-percent damage relationships in order to develop stage-damage relationships. Regression equations have been developed to estimate structure replacement cost from physical attributes which are easily obtained in the field. Contents values are also estimated from the data obtained in the field. For commercial properties, standard stage-damage relationships for 67 types of businesses are used. Utility and transportation damages and emergency care costs are also computed. The computer program is interactive and allows the user to correct data errors online. The program has several optional features and reports which are selected by the user. DAPROG 2 has been successfully used by the Baltimore District in several flood control studies. DAPROG 2 has also been used by other Corps Districts and state agencies. (Author's abstract)
W86-01102

EEC SHELLFISH DIRECTIVE IN WALES,

University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5G.
W86-01253

6G. Ecologic Impact Of Water Development

ABOUT A SOURCE OF NUTRIENTS IN THE TROPICAL RIVER RAJANG (N BORNEO) IN RELATION TO FUTURE IMPOUNDMENT,

Forschungsinstitut und Natur-Museum Senckenberg, Frankfurt am Main (Germany, F.R.).
A. Lelek.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2115-2118, 1985. 1 Fig, 9 Ref.

Descriptors: *Nutrients, *River Rajang, *Borneo, *Environmental effects, *Reservoirs, Water level, Water resources development, Resources development, Tropical regions.

Nutrients and organic matter in the large load of drifting vegetative debris in the Rajang River (North Borneo) could have serious negative consequences for the water quality within an impoundment if one were constructed in the upper reaches of this river. A distinctive characteristic of the Rajang River is its large, rapid changes in water level; daily changes of 3-5 m are the rule. This feature, combined with pulses of debris washed into streams by tropical storm runoff, creates a shifting load of vegetative debris, some of which contributes to the nutrition of fish and invertebrates in the river. The debris tends to be removed from the upper reaches of the river and moved downstream, where it accumulates particularly at the confluences with tributary streams. If an impoundment were constructed, this debris would wash into the impoundment, with potentially disastrous consequences for water quality (anaerobiosis, hydrogen sulfide release), particularly if existing vegetation is not removed from the affected area prior to flooding. It is recommended that vegetation be cleared from the zone to be flooded and that leaf traps be set up on tributary streams to trap forest litter so that it can become partly mineralized before carried into the man-made lake. (Rochester-IVI)
W86-00921

ORGANIC POLLUTION; MANAGEMENT OF FRESH WATERS: INPUT OF SCIENTIFIC DATA INTO POLICY FORMULATION IN THE UNITED STATES,

College of New Rochelle, NY. School of Arts and Sciences.
For primary bibliographic entry see Field 6A.
W86-00933

ENERGY EXTRACTION FROM LAKE SEDIMENTS WITH HEAT EXCHANGERS. EFFECTS ON WATER QUALITY, SEDIMENT, BOTTOM FAUNA, AND FISH,

Lund Univ. (Sweden). Limnological Inst.
L. Leonardson.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2249-2253, 1985. 4 Fig, 13 Ref.

Descriptors: *Energy sources, *Resource development, *Environmental effects, *Water quality, *Lake sediments, *Benthos, *Fish, Heat transfer, Water temperature, Sediments, Midges.

Studies conducted over the winter-spring 1982/83 period showed that a closed pipe heat exchanger system caused no negative or positive changes in water quality, sediment-water interactions, or bottom fauna in a Swedish lake. It is possible that the lack of observed environmental effects resulted from the relative mildness of the winter of 1982/83 (only 1 mo of ice cover). Water temperature near the pipe was as low as 2 C, but sediment oxygen levels, sediment chironomid levels, and rates of chironomid emergence did not differ between the sediments containing the pipe field and the undisturbed area. In this study, 3,300 m of pipe of 40 mm outside diameter was laid out on the sediments of an experimental lake of 18,000 sq m surface area in southern Sweden. Two closed pipe systems were used, one sunk down in the lake sediments and one dug down in an adjacent field. Brine temperature during winter within the sediments was expected to be less than -5 C. This heat exchange system resembles the more than 600 closed-system heat exchangers for energy extraction from lake water or sediment that have been installed in Sweden from 1978-82. (Rochester-IVI)
W86-00938

EFFECTS OF IMPOUNDMENT AND DRAWDOWN ON THE FISH COMMUNITY OF A SOUTH AMERICAN RIVER,

British Columbia Univ., Vancouver. Inst. of

Animal Resource Ecology.
T. G. Northcote, M. S. Arcifa, and O. Froehlich.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2704-2711, March, 1985. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Americana Reservoir, *Atibaia River, *Brazil, *Fish populations, *Eutrophication, *Dam effects, Reservoir operation, Water resources development, Environmental effects, Population dynamics, Food chains.

The Americana Reservoir (Brazil) was formed by a 25 m high dam constructed on the Atibaia River, some 500 km above its confluence with the middle Parana. Limnological characteristics of the eutrophic and polymictic reservoir are well documented as are general effects of pollution from sewage and industrial outfalls. The Atibaia River prior to impoundment had a moderately rich fish community probably composed of some 90 species, mostly characoids and siluroids. Of the 65 species apparently no longer present 30 years after impoundment, over two-thirds were siluroids whereas a lower reduction occurred in the characoids, leaving a post-impoundment fish community dominated by this latter group. Not all the changes in the fish community following impoundment of the Atibaia River can be related to changes associated with the shift from lotic to lentic conditions. During this same period there also has been marked eutrophication of the system as well as severe pollution by heavy metals, phenols, herbicides and other materials. The recent and sudden drawdown of Americana Reservoir apparently did not produce major changes in relative abundance of many fish species. The reduction in conditions for the planktivorous Astyanax following drawdown may be a food chain effect related to the concomitant decline in phytoplankton and zooplankton abundance. (Baker-IVI)
W86-00978

HUMIC ACIDS IN THE INFLOWS TO THE FLAJE RESERVOIR AFTER DEFORESTATION OF ITS WATERSHED,
Vyzkumny Ustav Vodohspodarsky, Prague (Czechoslovakia).
J. Micka, L. Fiala, and J. Chalupa.
Acta Hydrochimica et Hydrobiologica, Vol. 13, No. 1, p 47-52, 1985. 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Humic acids, *Deforestation, *Watersheds, *Flaje Reservoir, *Czechoslovakia, Air pollution, Peat bogs, Forest watersheds, Chemical oxygen demand, Color, Nitrates, Vegetation.

Flaje Reservoir (Czechoslovakia) was first filled in 1960. Water quality in the reservoir after filling was compared with that for the period 1976-1982. When the reservoir was first filled, 70% of the watershed was still covered by forests; at present only about 35% of the area is covered by forests and the large peat bogs are practically bare of trees. This deforestation was caused by air pollution from a nearby industrial region. The concentration of humic matter decreased from the original 8 mg/l to 4 mg/l. The relationships between the COD-Mn and humic acid concentration, and color can be described by a linear function. Parallel to deforestation, the nitrate concentration increased; this can be explained by the higher nitrogen concentration in precipitation. The improvement in color, COD, and humic acid concentrations after deforestation may be due to coherent plant growth that developed on the deforested surface of peat bogs and prevented the original erosion and eluation of the forest soil. (Moore-IVI)
W86-01010

RESERVOIR IMPACTS: A SYNTHESIS OF A 10-YEAR RESEARCH PROJECT,
Ohio Agricultural Research and Development Center, Wooster. Dept. of Agricultural Economics.
T. L. Napier, W. R. Goe, and M. V. Carter.
Water Resources Research, Vol. 21, No. 6, p 801-807, June, 1985. 34 Ref.

Descriptors: *Reservoirs, *Social aspects, Environmental effects, Water resources development, Ohio.

The purpose of this paper is to present a synthesis of research findings derived from longitudinal monitoring of a reservoir affected community group located in the urban fringe of a major metropolitan community in central Ohio. Data were collected at three time periods to assess the social impacts of rapid change on local people. Data were collected over a 10-year period using standardized measurement devices to ensure comparability of the information collected. The research findings demonstrate that extensive modification of social and physical environments did not result in the destruction of the social fabric of the affected group. Observations over time suggest that the affected group has accommodated many of the changes introduced in the community and has accepted the lake project. (Author's abstract)
W86-01071

SIMULATING FISH REDISTRIBUTION IN THE LG-2 RESERVOIR AFTER FLOODING,
Sherbrooke Univ. (Quebec). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 8I.
W86-01166

GROWTH RATE OF YEARLING COLORADO SQUAWFISH AT DIFFERENT WATER TEMPERATURES,
National Fisheries Center-Leetown, Kearneysville, WV.
T. Black, and R. V. Bulkey.
Southwestern Naturalist, Vol. 30, No. 2, p 253-257, May, 1985. 2 Tab, 15 Ref.

Descriptors: *Water temperature, *Ecological effects, *Water resources development, *Squawfish, *Growth, Fish physiology, River basin development, Resources development, Animal physiology, Fish populations.

One of the major habitat changes imposed on the upper Colorado River drainage by dam construction was an altered annual water temperature pattern which results in much lower summer water temperatures in significant portions of the drainage. Specimens of the endangered Colorado squawfish, Ptychocheilus lucius, which have been caught in recent years have been half as long as specimens caught in the past; the change in annual river temperature has been cited as the possible cause of an apparent reduction in growth rate of the species. Research was conducted to determine the optimum growth temperature for Colorado squawfish and the relation between optimum growth temperature and final thermal preferendum for this species. Growth rate of yearling Colorado squawfish over a 12-week period was determined for fish held at 15, 20, 25, and 30 C with excess food. The effect of temperature on growth rate was highly significant; fastest growth occurred at 25 C. Fish gained about 0.3 gram at 15 C, 0.9 gram at 20 and 30 C. and 1.7 grams at 25 C during the 12-week period. Results suggest that 25 C, the final thermal preferendum, is the temperature at which Colorado squawfish grow fastest with abundant feed. Reduced water temperature below dams in the Colorado River drainage could well have lowered growth rate of Colorado squawfish from historic levels. Future water shortage and development projects should be designed to provide summer water temperatures as near the optimum growth level as feasible. (Collier-IVI)
W86-01169

AQUATIC HABITAT ANALYSIS AS AN ELEMENT OF WATER RESOURCES PLANNING AND MANAGEMENT,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W86-01228

SURFACE WATER QUALITY IN RELATION TO SOIL TYPE, LAND USE AND DISCHARGE IN A RURAL CATCHMENT AREA,
Utrecht Rijksuniversiteit (Netherlands). Environmental Research Group.
For primary bibliographic entry see Field 5B.
W86-01249

ANALYSIS OF THE BENTHIC MACRO... TEBRATE COMMUNITY OF A FLUCTU... RIVER-RESERVOIR ZONE IN MIDDL... NESSEE,
Florida State Dept. of Environmental Reg... West Palm Beach.
S. K. Burian.
Journal of the Tennessee Academy of ... Vol. 60, No. 3, p 79-84, July, 1985. 4 Fig, 2 ... Ref.

Descriptors: *Benthic environment, *... brates, *Tennessee, *Rivers, *Reservoirs, ... distribution, Temporal distribution, Popula... namics, Dam effects, Environmental effects...

The effects of controlled retention on the s... of the benthic macroinvertebrate communit... Falling Water River within the headwaters ... influence of Center Hill Reservoir in Mid... nessee were investigated. Changes in benth... munity structure in relation to changes ... channel morphology were studied using ... analysis. Associated matrices and dend... were constructed using the Pinkham and ... coefficient of association. Distinctly ... benthic communities were identified throu... ter analysis and appeared to result from t... ation of micro- and macrohabitats as fluctu... river-reservoir stage occurred. In addition, ... analysis with the Pinkham and Pearson co... proved to be an effective means of providin... mation on the relative environmental toler... the 94 taxa of benthic invertebrates id... during this study. (Baker-IVI)
W86-01317

7. RESOURCES DATA

7A. Network Design

VARIANCE REDUCTION ANALYSIS,
Georgia Inst. of Tech., Atlanta. School ... Engineering.
For primary bibliographic entry see Field 2...
W86-01075

CONTINUOUS CONVOLUTION WIT... DROLOGIC DATA,
New South Wales Univ., Kensington (Au... School of Civil Engineering.
For primary bibliographic entry see Field 2...
W86-01076

7B. Data Acquisition

COMPARISON OF PLANKTONIC AND... PHYTIC MICROALGAL PARAMETERS ... DICATORS OF EUTROPHICATION ... BALTIC ARCHIPELAGO: ANNUAL SU... SION OF COMMUNITY PARAMETERS,
Tvarminne Zoological Station (Finland).
T. Tamminen, and E. Leskinen.
Verhandlung Internationale Vereinigung L... gie, Vol. 22, No. 4, p 2195-2202, 1985. 5 Fig, ... 8 Ref.

Descriptors: *Phytoplankton, *Periphyton ... trophication, *Bioindicators, *Archip... *Baltic Sea, *Finland, *Succession, Indicato... trients, Primary productivity, Phosphorus, ... toring.

The value of periphyton studies in practica... toring was illustrated by a study in which ... tonic and periphytic primary productivity, ... phyll a, particulate organic carbon, and n... were compared as indicators of eutrophicati... to ammonium pollution in a brackish water ... pelago in the Baltic Sea on the southern c... Finland. Periphyton was sampled on 10 x ... tile-red ceramic panels, which were exposed ... bottom (depth 2 m) at an angle of 45 d... facing southwest. Exposures lasted 5 wk, ... during winter when substrates were expos...

Nutrient ratios (inorganic N/P and nutri-
ce ratio) indicated a phosphorus deficien-
me spring and early summer samples,
nitrogen appeared to be the main limiting
or algal growth at other periods. Of the
phytoplankton parameters, only the pri-
ductivity/particulate organic carbon (P/
iffered consistently between the polluted
ol areas. Periphytic microalgal coloniza-
10 times greater in the polluted area
rly summer. The average turnover time
mmunity (B/P) was an order of magni-
er in periphyton than in the plankton.
hyton community is more cumulative
dynamic than the plankton community,
vs succession within time frames that are
for sensitive monitoring of the aquatic
nt. (Rochester-IVI)

ION OF THE USE OF ARTIFICIAL TES IN SAMPLING THE INVERTE- FAUNA OF SEWAGE FUNGUS N IRISH RIVERS,
ll., Dublin (Ireland). Dept. of Zoology.
olds, and C. Hunter.
ng Internationale Vereinigung Limnolo-
, No. 4, p 2239-2243, 1985. 3 Fig, 1 Tab,

: *Biological samples, *Benthos, *Arti-
ates, *Sewage fungus slimes, *Ireland,
ater pollution effects, Bioindicators, In-

on pan scourers, approx 9 cm in diame-
thick, collected stream invertebrates in
was broadly comparable to standard-
amples at upstream sites and sewage
ections at downstream sites, thus per-
parison between these two different
amples were collected, and artificial
ere exposed, during August and Sep-
wo tributaries of the River Shannon,
e scourers placed upstream yielded
bers of organisms and taxa to those in
amples, but biomass of substrates was
ty tended to be lower in the substrates
samples. Although some differences
-scourers and sewage fungus samples
ed at downstream sites (where domes-
food, or milk waste pollution was
downstream scourers appeared to
etation overgrown by sewage fungus
according to faunal results. Kick
ed to collect more worms, leeches,
than did sewage fungus samples,
red with scourer results in each case.
rers were most attractive to crevice-
anisms such as Asellus, Gammarus,
la, whereas those requiring a firm
Similium larvae) were less favored.
are cheap, standard, and easily used
xperimental configurations, and they
to the difficult conditions of variable
ely eroding stream beds encountered
streams. (Rochester-IVI)

ACTERIA ATTACHED TO SUB- MACROPHYTES AND GLASS INDICATORS OF AN INCREAS- POLLUTION,
niv., Stuttgart (Germany, F.R.). Inst.
de und Standortslehre.
nd J. C. G. Ottow.
Internationale Vereinigung Limnolo-
o. 4, p 2297-2302, 1985. 4 Fig, 1 Tab,

Bacteria, *Epiphyton, *Bioindica-
ollution effects, *River Erms, *Ger-
l Republic), Indicators, Macro-
c plants, Species composition, Nutri-

mmunity of bacteria epiphytic on
ula erecta and Ranunculus tricho-
iphytic on exposed glass slides was
oligotrophic and a eutrophic site on
s (West Germany), a chalk stream.

Light microscopy and scanning electron microscopy were employed. Periphyton of the differently polluted zones showed characteristic 'Aufwuchs', depending on the time of exposure. Slides from the oligotrophic site revealed mainly cocci within 3 days, whereas those exposed in the eutrophic zone showed densely scattered rods and sheathed forms directly after exposure. The longer the exposure period, the more similar were the periphytic microfloras of the two sites, both in terms of size and forms. The bacteria on B. erecta and R. trichophyllus appeared to be concentrated in the grooves of the leaves. This epiphyton at the unpolluted site consisted mainly of rod-shaped cells and threads that showed remarkable similarity to the periphytic 'Aufwuchs' observed at the eutrophic site. Bacteria from the oligotrophic site may be considered as 'Kuemmerformen' (starved forms); they appear to develop into rods if exposed to higher nutrient supplies for a longer period. Nutrients derived from plants (or leaf exudates) may account for the smaller differences observed between epiphytic floras from polluted and unpolluted sites than between the glass slide microfloras from these sites. (Rochester-IVI)
W86-00943

MULTILEVEL APPROACH TO THE ASSESSMENT OF ECOTOXICOLOGICAL EFFECTS IN A HEAVY METAL POLLUTED STREAM,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W86-00953

USE OF AQUATIC BRYOPHYTES TO MONITOR HEAVY METALS POLLUTION OF FRESHWATERS AS ILLUSTRATED BY CASE STUDIES,
Metz Univ. (France). Lab. d'Ecologie.
C. Mouvet.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 4, p 2420-2425, 1985. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Bioindicators, *Bryophytes, *Heavy metals, *France, *Cance River, *Fensch River, *Bienne River, Metals, Water pollution effects, Bioaccumulation, Indicators, Arsenic, Cadmium, Copper, Iron, Lead, Zinc.

Applications of aquatic bryophytes as monitors of heavy metal contamination are illustrated by three case studies; a tannery, iron and steel plants, and metal coating factories. Along the Cance River (a tributary of the Rhone River, France), where tannery effluents were present, Platyhypnidium exhibited slightly higher contents of metals (As, Cd, Cu, Fe, Pb, Zn) than Fontinalis at most stations, but the downstream profiles were similar. Along the Fensch River (a tributary of the Moselle River, France), where steel rolling mills and blast furnaces are responsible for heavy metal inputs, new records were set for concentrations of metals in aquatic bryophytes (P. riparioides): 277 g Zn/Kg, 98 g Fe/kg, 15 g Cr/kg, 3.7 g Cu/kg, 2.9 g Pb/kg, and 187 mg As/kg. The record values of Fe, Cr, and As were obtained on bryophytes transplanted for just three days in the most polluted site. At the third site, the Bienne River (a tributary of the Ain River, France), where many small metal coating factories contribute pollution, it was possible to pinpoint individual sources of Cu among 13 metal coating factories located as little as 300 m apart. Aquatic bryophytes offer numerous advantages in pollution monitoring compared to other organisms such as phytoplankton, periphyton, macrophytes, and macroscopic algae. Bryophytes (Cinclidotus, Fontinalis, Platyhypnidium, Scapania, and others) are easily sampled and identified, have high concentration factors, are attached and perennial, tolerate high levels of toxicants, and show a highly significant correlation between their contents of heavy metals and concentrations in the water. (Rochester-IVI)
W86-00962

PHOTOSYNTHETIC ACTIVITY OF DOMINANT ALGAL SPECIES IN EUTROPHIC SHALLOW LAKE (GROSSER MUGGELSEE, BERLIN) INVESTIGATED BY MICROAUTORADIOGRAPHY,
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
For primary bibliographic entry see Field 2H.
W86-01131

SUITABILITY OF DIFFERENT COUNTING VIALS AND LIQUID SCINTILLATORS FOR DETERMINING TRITIUM IN WATER (DIE EIGNUNG VERSCHIEDENER MESSFLASCHCHEN UND SZINTILLATORFLUSSIGKEITEN ZUR BESTIMMUNG VON TRITIUM IN WASSER),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
W. J. Krause.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 18, No. 3, p 141-160, June, 1985. 16 Fig, 6 Tab, 1 Ref.

Descriptors: *Measuring instruments, *Tritium, *Liquid scintillators, Water analysis, Calibrations, Sensitivity, Radioisotopes.

Twentyone glass and plastic counting vials and 15 liquid scintillators commercially offered for determining tritium in water have been examined with regard to their suitability. For this purpose a comparison of their characteristics has been made, including counting efficiency, quality quotient, figure of merit, calibration factor and sensibility of measurement arrangement and also the mean background for samples in several 20 ml counting vials at optimum mixing ratio of scintillator cocktail to water. From this comparison a qualitative assessment has been derived and on this basis suitable counting vials and liquid scintillator cocktails for determining high and low tritium contents (low level range) have been recommended. (Author's abstract)
W86-01142

LEACHATE ATTENUATION IN THE UNSATURATED ZONE BENEATH LANDFILLS: INSTRUMENTATION AND MONITORING OF A SITE IN SOUTHERN ENGLAND,
Aspinwall and Co., Shrewsbury (England).
For primary bibliographic entry see Field 5A.
W86-01177

ANALYSIS OF ORGANICALLY COMPLEXED ELEMENT CONTENTS IN SEDIMENTS AND SLUDGES (ZUR ANALYTIK ORGANISCH-KOMPLEXIERTER ELEMENTGEHALTE IN SEDIMENTEN UND SCHLAMMEN),
Goettingen Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie.
W. Schlosser, and G. Schwedt.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 321, No. 2, p 136-140, May, 1985. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *Complexation, *Metals, *Chemical analysis, *Sediments, *Sludge, *Extraction, Lead, Copper, Zinc, Organic solvents, Sequential extraction, Sodium acetate, Ammonium acetate, Fate of pollutants.

The extractability from a purification sludge of organically bound Pb, Cu and Zn with various organic solvents is studied systematically. A significant part in the range of 10% of the whole content was found for Cu only. Liquid-liquid distribution of the ammonium and sodium acetate extracts from the standard sequential extraction procedure by organic solvents in combination with photometric direct determinations of the labile contents show that the metals Fe, Cu and Zn are complexed to different extents. The results of this differentiating analysis for some sludges and sediments are demonstrated. (Author's abstract)
W86-01301

LABORATORY INVESTIGATION AND ANALYSIS OF A GROUND-WATER FLOWMETER,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-01310

7C. Evaluation, Processing and Publication

ANALYTICAL REPRESENTATION OF THE VAN EVERDINGEN-HURST AQUIFER INFLUENCE FUNCTIONS FOR RESERVOIR SIMULATION,
Keplinger and Associates, Inc., Tulsa, OK.
For primary bibliographic entry see Field 2F.
W86-01139

8. ENGINEERING WORKS

8A. Structures

RECONSTRUCTION OF A DAM WATER INTAKE UNDER CONDITIONS OF CONTINUOUS OPERATION OF THE RESERVOIR,
S. S. Golik.
Hydrotechnical Construction, Vol. 18, No. 10, p 484-489, October, 1984. 5 Fig, 1 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 20-23, October, 1984.

Descriptors: *Intakes, *Dam construction, *Reconstruction, Earth dams, Tunnels, Embankments.

In 1983, construction was completed on building up the barrier of a reservoir in the Crimea, consisting of a class II earth dam, retaining embankment, and concrete overflow dam. Simultaneously, the dam water intake was reconstructed. The reservoir was operated continuously as a water supply during the reconstruction period. The dam intake consists of a tunnel located under the dam, head and tail walls. Considerable deformation occurred in the intake tunnel after the first phase of filling the reservoir. The intake reconstruction involved reinforcement of the tunnel and dry chamber of the head wall, and the provision of intake at the increased useful storage level after the reconstruction of the reservoir. A continuous operation regime of the intake and deliver of water to consumers during repair of the structures was maintained. (Keenan-IVI)
W86-00990

MODEL FOR BEAM-MODE BUCKLING OF BURIED PIPELINES,
Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
H. Yun, and S. Kyriakides.
Journal of Engineering Mechanics, Vol. 111, No. 2, p 235-253, February, 1985. 17 Fig, 1 Tab, 16 Ref. NSF grant CEE-8140043.

Descriptors: *Pipelines, *Beam mode buckling, *Compression, Seismic properties, Pipes, Mathematical models, Deformation, Buckling, Mechanical failure, Design criteria.

Large ground movements (such as fault movements, landslides, and sediment subsidence) can cause a line to develop compressive loads which can lead to buckling. Lines on the ground surface or buried in relatively shallow trenches tend to behave essentially as beams. Under compression, a section of the line lifts through the ground. An attempt is made to modeling the so-called 'beam mode buckling' exhibited under compression in pipelines. The line is modeled as a long heavy beam on a contacting surface. The reacting surface is modeled first as an elastic and subsequently as a rigid foundation, with the additional constraint that it only reacts to compressive loads. The problem is assumed to possess a localized imperfection. Under compressive axial load, a section of the beam lifts off the foundation. The problem is studied through a large deflection extensional beam nonlinear formulation. The large deflection response of the beam is found to exhibit a limit load which is shown to be imperfection sensitive. Numerical examples using actual pipe parameters clearly indicated that the limit load is reached with relatively small vertical and axial displacements of the beam. Provided the pipe continues to behave as a beam (i.e., the limit load is less than the shell-buckling load of the pipe), the pipe can sustain deformations well beyond the limit load without failure. Pipelines can be designed to ensure that in the event of excessive compression, they buckle out of the ground but remain operational and structurally sound. This can be achieved by designing periodically placed imperfections in the pipeline. (Moore-IVI)
W86-01079

SIMPLIFIED EARTHQUAKE ANALYSIS OF CONCRETE GRAVITY DAMS: SEPARATE HYDRODYNAMIC AND FOUNDATION INTERACTION EFFECTS,
Texas Univ. at Austin. Dept. of Civil Engineering.
G. Fenves, and A. K. Chopra.
Journal of Engineering Mechanics, Vol. 111, No. 6, p 715-735, June, 1985. 12 Fig, 20 Ref, 1 Append. NSF grants CEE-8120308 and CEE-84011439.

Descriptors: *Earthquakes, *Gravity dams, *Hydrodynamics, *Dam foundation, Concrete dams, Vibration, Reservoirs, Mathematical equations.

Simplified procedures are presented for the analysis of the fundamental vibration mode response of concrete gravity dam systems for two special cases: (a) Dams with reservoirs of impounded water supported on rigid foundation rock; and (b) dams with empty reservoirs supported on flexible foundation rock. In the first case, the effects of dam-water interaction and reservoir bottom absorption on dam response are included, whereas the effects of dam-foundation rock interaction are included in the second case. In each case, the response of the fundamental vibration mode of a dam monolith is modeled by an equivalent single degree-of-freedom system with frequency-independent properties chosen to represent the effects of complicated, frequency-dependent hydrodynamic terms or foundation-rock flexibility terms, as appropriate. The maximum earthquake-induced deformations and equivalent lateral forces can be computed using the response spectrum for a special ground motion. The procedures and results presented in this paper are extended in a companion paper to develop a simplified analytical procedure for concrete gravity dams that includes the simultaneous effects of dam-water interaction, reservoir bottom absorption, and dam-foundation rock interaction. (Author's abstract)
W86-01080

SIMPLIFIED EARTHQUAKE ANALYSIS OF CONCRETE GRAVITY DAMS: COMBINED HYDRODYNAMIC AND FOUNDATION INTERACTION EFFECTS,
Texas Univ. at Austin. Dept. of Civil Engineering.
G. Fenves, and A. K. Chopra.
Journal of Engineering Mechanics, Vol. 111, No. 6, p 736-756, June, 1985. 8 Fig, 10 Ref, 2 Append. NSF grants CEE-8120308 and CEE-8401439.

Descriptors: *Earthquakes, *Gravity dams, *Hydrodynamics, *Dam foundations, Concrete dams, Rock mechanics, Dam-water interactions, Reservoirs, Mathematical equations.

A companion paper presented simplified procedures for earthquake analysis of the fundamental mode response of concrete gravity dams including the separate effects of dam-foundation rock interaction and dam-water interaction with reservoir bottom absorption. These procedures are extended to develop a simplified analytical procedure for evaluation of the response of concrete gravity dams to earthquake ground motion including the simultaneous effects of dam-water interaction, reservoir bottom absorption, and dam-foundation rock interaction. Expressions for the parameters of an equivalent SDF (single degree-of-freedom) system that models the fundamental mode response of dams are derived, a procedure to implement the analytical procedure is outlined, and an extension to consider the response contributions of the higher vibration modes of the dam is briefly mentioned. (Author's abstract)
W86-01081

HYDRAULIC DESIGN OF FREE OVER-FALL SPILLWAY,
Masan Dam Investigation Div., Bagaha (
C. Singh.
Indian Journal of Power and River Valley
opment, Vol. 33, No. 7/8, p 204-212, July-A
1983. 17 Fig, 11 Ref.

Descriptors: *Free over-fall spillways, *Spil
Hydraulic design, Arch dams, Buttress
Gravity dams, Control crest, Terminal stru
Hydraulic head, Aeration.

In the free over-fall spillway, the discharg
flowing over the control crest falls into the
stream, because there is no structure belo
porting crest up to the point of impingem
support that falling jet. The free over-fall sp
is always an integral part of a dam of arch, b
or gravity type with the downstream face
or of reverse slope. It has only two compo
the control crest on the top and the terminal
ture at the toe of the dam, with adequate pro
of aeration below the lower nappe of th
falling flow. This type of spillway is limi
particular types of dams, and it involves sim
of design and overall economy in project
operation and maintenance. Discharge inc
with increase in operating head and the ope
head has no barrier, so it is hydraulically ef
The terminal structure provided at the toe
dam protects it and adjoining works fro
eroding and undermining action of the sp
discharge. This type of spillway has provide
ble-free service at the 230 ft high Calder
Arch Dam built in Tennessee in 1930 and the
high Couesque Arch Dam (France) built in
This type of spillway has enough scope for
tion in case the spillway is to be based on a c
well foundation. (Moore-IVI)
W86-01208

ROLE OF CONSTRUCTION MANAGEM METHODS AND EQUIPMENT IN STRUCTION OF HYDROELEC PROJECTS IN INDIA,
National Hydroelectric Power Corp. Ltd.,
Delhi (India).
O. P. Sharma.
Indian Journal of Power and River Valley
opment, Vol. 33, No. 9/10, p 249-256, Septe
October, 1983.

Descriptors: *Hydroelectric plants, *India,
struction, Management, Mechanization, M
ment information systems, Planning, Mainte
Economic aspects, Safety.

Speed, economy, quality and safety being
considerations in hydro-power project con
tions having unique problems, modern con
tion management and technology, advanced
ods and techniques, greater mechanizatio
import of consultancy and expertise are the
answers. Network planning techniques, m
ment information system, sound organiz
teamwork in congenial construction atmos
need based and result oriented approach are
tial ingredients. Scientific and systematic co
tion planning, programming, phasing and sy
nizing sequence of construction using appro
methods and techniques lead to accele
progress. Equipment planning by experts,
procurement and commissioning of constru
plant, their optimum use avoiding idling of
equipment, regular maintenance for high effic
and adequate supply of spares and access
ensure speed and economy. Safety consider
both during training and operation of ded
operators/workers would ensure speed an
pendability in high mechanization. (Author
stract)
W86-01209

FARAKKA - THE LARGEST BARRAGE IN WORLD - AN ENGINEERING MARVEL,
Gujarat Narmada Water Dispute (India).
D. Mookerjea.
Indian Journal of Power and River Valley D
opment, Vol. 33, No. 9/10, p 282-289, Septem
October, 1983. 6 Ref.

Descriptors: *Farakka Barrage, *Ganga R
*India, *Bangladesh, *West Bengal, Construc

ater resources development, Barrages, Flow discharge.

ka Barrage built across the Ganga is r the border of West Bengal, India and . The Ganga is a perennial river with an ter level in the non-monsoon season about EL 55.00 (16.8 m) and corre- scharge of about 3.976 cu m/sec. In the ason, July to September, the water lly rises to about EL 80.00 (24.40 m). a Barrage was constructed right inside annel of the river with a movable bed and minimum depth of water in the f about 20 ft, 6 m. Problems of con- d the sequence of construction of are discussed. A type of coffer dam ing the construction accounted for a ost reduction. Even before the Far- x was commissioned, the rail and road een opened to traffic. With an ad hoc etween India and Bangladesh regard- of Ganga waters, pending final ar- e Farakka Complex had started oper- e end of April 1975 with a discharge ecs. The effect of this reduced dis- udied by a joint team of experts. The ough Farakka Canal was maintained ecs even after the monsoon of 1975. d provided remarkable improvement ble reaches and the usual change of el during ebb tide in the earlier years Baker-IVI)

RY OF 1000 MW DEHAR POWER S SUTLEJ LINK PROJECT,
lwara.
d S. L. Aggarwal.
of Power and River Valley Devel- 33, No. 9/10, p 290-307, September- 11 Fig, 1 Tab, 11 Ref.

Hydroelectric plants, *Construction, , Management, Turbines, Genera- c aspects, Construction materials, quipment, Administration.

/ capacity Dehar Power Plant is achal Pradesh, India. The water for bines is obtained by diverting the river Deas through the Pandoh The construction work on this limb ommenced in 1972 and the first of ng units each of 165 MW installed ommissioned in November, 1977. ussed include: choice of speed of pe of generators; control of silt er plant; seismic design; method ce second stage concrete around the provision of combined cooling tube unwatering pumps and obser- al distribution of discharge from f the draft tube. Design and con- s for expeditious and economic uture hydro-power plants are con- g the benefits of providing two ch of half of the total capacity on of precast crane girders and nechanization of production and ncrete; introduction of 1 ft sheets nt bar lists for job facility; and mplete reinforcement cages for mns in the workshop and their site. The administration, while he framework of rules, should be erate, decisive and ready to e constraints of the rules when terest of work. The construction be based on detailed investiga- umeration and cash incentives d for the project staff working in dous areas and along the critical

TUNNELLING - A LAND- N TUNNELLING PRACTICE,
ectric Power Corp. Ltd., New

Roy.

Indian Journal of Power and River Valley Development, Vol. 33, No. 9/10, p 349-353, 364, September-October, 1983. 3 Fig, 7 Ref.

Descriptors: *Construction, *Tunnel construction, *India, *Manipur, Tunnels, Water resources development, Planning, Mechanization, Hydroelectric plants, Geology, Penstocks.

The role of mechanized tunnelling in India is considered along with conditions under which it may be deployed and the experienced gained during the process in the maiden Indian hydroelectric project. India saw its first mechanized tunnelling operation in Loktak Hydroelectric Project in the State of Manipur. The 100 million dollar Loktak Hydroelectric Project situated in the Manipur State anticipates diversion of 58.8 cumecs of water from the Loktak Lake with a view to utilize 42 cumecs for generation of power with a gross head of 312 meters and supply of 16.8 cumecs for lift irrigation. The water will be diverted from the lake through a water conductor system comprising 2.27 km of open channel, 1.073 km of cut and cover section and 6.65 km long, 3.81 m finished diameter of horsehoe shaped head race tunnel terminating in the penstock manifold at the surge tank end. The three penstocks laid on the surface slope of the hill have an average length of 1346 meters each. The power plant situated at the bank of Leimatak river houses 3 units of 35 MW each. The tunnel traverses through lake sediments in the initial reaches followed by terrace deposits in about 1250 km length and splintery shales with subordinate sandstone and silt stone bands of Disangs and Barail Series in the remaining reach. A number of predominant faults have affected these rock formations with steep dip either towards east or west. The use of the Alpine Miner AM-50 is described, which is a selective cutting machine designed for operation in medium hard rock up to an unconfined compressive strength of about 1000 kg/sq cm. The machine can economically excavate a wide range of rocks encountered in underground mining and tunnelling. (Baker-IVI)
W86-01216

TUNNEL EXCAVATION WITH ALPINE MINER AM-50 (A CASE HISTORY AT LOKTAK H.E. PROJECT, MANIPUR),
Loktak Hydroelectric Project (India). Management Services Div.
D. P. Verma, and M. M. Madan.
Indian Journal of Power and River Valley Developments, Vol. 33, No. 9/10, p 354-364, September-October, 1983. 2 Fig.

Descriptors: *Tunneling, *Construction equipment, *Excavation, Loktak Hydroelectric Project, Manipur, India, Hazardous conditions, Methane, Hydroelectric plants.

The work of tunnelling at the Loktak Hydroelectric Project, Manipur, India was suspended due to a methane gas explosion during excavation in 1975. In 1977, construction on two faces was resumed using two roadheader Alpine miners AM-50 (imported from Austria) A detailed study was made on the working of the machine, consumption of spare parts under different geological conditions, and the various practical problems. If the machine breaks down, it may not be possible to move it out until it is repaired. No arc welding or gas cutting is allowed inside the tunnel because it contains highly inflammable methane gas, which resulted in unanticipated delays. The machine is most suitable only where supporting system is of secondary importance and continuous excavation is possible so as to get maximum utilization of the machine. In tunnels where rock strength ranges from 150 to 400 kg/sq cm, after excavation the rock has to be supported immediately and the maximum time is taken for providing permanent supports. In soft ground conditions where seepage water is present, bogging down of the miner consumes most of the time and the operation must be carried out very carefully. (Moore-IVI)
W86-01217

THREE DIMENSIONAL FINITE ELEMENT STRESS ANALYSIS OF GRAVITY DAMS,
Indian Inst. of Tech., New Delhi.
D. K. Sehgal, R. Natarajan, and S. M. A. Kazimi.
Indian Journal of Power and River Valley Development, Vol. 33, No. 11, p 394-396, November, 1983. 4 Fig, 7 Ref.

Descriptors: *Gravity dams, *Finite element method, *Stress analysis, Computers, Model studies, Dams, Stress, Strain, Concrete dams.

Three dimensional finite element analysis of a concrete gravity dam block is done and results are compared with those obtained by a two dimensional finite element analysis. The geometry of a 100 m high concrete gravity dam was chosen for this study. The dam is divided into 49 elements with 246 nodes. Twenty noded, isoparametric, rectangular prism elements are used and displacements are allowed to vary in parabolic fashion. There are differences between the stresses predicted by 2D and 3D analysis. The major point of difference is the area of the tension zone. A 2D analysis shows a smaller tension zone surrounding the heel of the dam and upstream face of the foundation, whereas 3D analysis gives a much bigger tension zone. For the preliminary design of a dam, to save computer time and man time, one can go ahead with 2D analysis. However, for the exact analysis for final design, 3D analysis is recommended. This becomes almost essential for the cases where either the foundation is nonhomogeneous or the geometry of the dam changes along the longitudinal axis. This type of study keeps a stress analyst aware of the magnitude of inaccuracies involved in simple plane strain analysis for such problems. (Baker-IVI)
W86-01219

TOMORROW'S TECHNOLOGY FOR TODAY'S PROBLEMS,
Wessex Water Authority, Bristol (England).
K. F. Roberts.
Journal of the American Water Works Association, Vol. 77, No. 6, p 59-65, June, 1985. 5 Fig, 8 Ref.

Descriptors: *Water supply systems, *England, *Wales, *Wessex, *Management planning, *Administrative agencies, Water distribution, Water districts, Water mains, Maintenance costs, Sewer systems.

Since standards in Britain vary so greatly, even within a single network, and programs of asset replacement have only in more recent years been tackled in a planned and systematic way, the traditional problems of water distribution (peak demand, pressure variations, burst mains, unaccounted-for water) have increased in seriousness rather than having been overcome. The problems associated with aging underground distribution networks in the United Kingdom are being addressed at the national and regional levels. Some 80,000 burst pipes, excluding mains, are repaired each year, and the cost of these repairs is at least $75 million annually; most of the bursts occur in lines of 6 in. diameter or less, which represents 80% of the nation's distribution system. The 1974 reorganization of management of the entire water cycle in England and Wales created 10 regional water authorities whose boundaries were decided on the basis of natural water basin catchments rather than on artificial political or commercial criteria. The Wessex Water Authority's use of telemetry to reduce stresses on distribution networks and extend the life of underground assets is described. The potential effectiveness of renovation as an alternative to replacement was demonstrated by calculations that show that if renovation could be applied to two thirds of the system at, say, a third of the cost of replacement, then the total cost of overall replacement would be cut by nearly half. A major change in the financial regulations under which water authorities operate was introduced in Great Britain in 1982 with a move from historical- to current-cost accounting. (Collier-IVI)
W86-01261

ENERGY STORAGE: DEVELOPMENTS IN PUMPED-STORAGE,
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Machines Hydrauliques.

For primary bibliographic entry see Field 8C.
W86-01272

DESIGN AND OPERATION OF A FUSE-PLUG SPILLWAY IN SWAZILAND,
Watermeyer, Legge, Piesold and Uhlmann, London (England).
E. T. Engels, and A. Sheerman-Chase.
International Water Power and Dam Construction, Vol. 37, No. 6, p 26-28, June, 1985. 4 Fig, 1 Tab, 4 Ref.

Descriptors: *Design criteria, *Spillways, *Fuse-plug spillways, *Swaziland, *Umbuluzi River, Water resources development, Dam construction, Costs, Floods.

The combination of a concrete-lined spillway and an emergency spillway with a two-level erodible bund control provided an economical accomodation of flood discharges resulting from Cyclone Domoina, which deposited more than 400 mm of rain on the catchment above the Umbuluzi River dam at Mnjoli, Swaziland. Within less than half an hour, the double-bund fuse plug washed out, and the spillway opened. Topsoil and vegetation in the valley below the spillway were washed away in a strip about 120 m wide, and the flood eroded a channel some 40-60 m side and up to 10 m deep. The dam was not damaged, nor was their unacceptable loss of freeboard as a result of this flood event. The emergency spillway operation was entirely controlled by the water level, with no human intervention. The spillways at Mnjoli cost $1,118,800 (1977 prices), of which 63% was for the concrete spillway and 37% for the emergency spillway with the erodible fuse-plug bunds. The cost of reinstatement of the erodible bunds in the emergency spillway is estimated to be $40,800 (1984 rates), and to replace a waterline and gravel road below the spillway that were washed away will require an additional $9,100. (Rochester-IVI)
W86-01275

POWER CONDUITS FOR HIGH-HEAD PLANTS,
Innsbruck Univ. (Austria). Inst. fuer Konstruktiven Wasserbau und Tunnelbau.
G. Seeber.
International Water Power and Dam Construction, Vol. 37, No. 6, p 50-54, June, 1985. 10 Fig, 12 Ref.

Descriptors: *High-head storage plants, *Pumped storage, *Pressure tunnels, *Tunnels, Tunnel lining, Stress, Design criteria, Pipelines, Concrete, Unlined tunnels, Construction joints, Construction materials.

Loading of pressure tunnels and shafts, and lining techniques are reviewed, with particular reference to the problems existing in plants of large size (600-700 MW), heads of up to 1,000-1,500 m, and dam heights up to 300 m. Increases in hydrostatic load have not been the main source of problems in these new plants, rather, it has been the increase the dynamic, or pulsating load, that has caused problems in conduits. Introduction of automatic control equipment has meant more abrupt changes in operating conditions. Incorporation of a reverse-flow control throttle (Thoma throttle) in the surge chamber has helped reduce large oscillation in this area. Operation in the pumping mode involves higher frequency, but smaller amplitude pressure waves which quickly lead to alternating stress numbers greater than 10 to the 10th power. Imposing operating restrictions or incorporating damping elements are ways to reduce dynamic load in peak-load stations. Rock pressure cannot be counted on as a counteracting external force to equalize pressure on the inner lining of conduits. Only groundwater pressure can be incorporated into lining calculations as a pressure relief, particularly where it is higher than the turbine water pressure. Lining techniques suitable for high-pressure power conduits include no lining in suitable rock and concrete linings, of which the latter are particularly common in the Alps. In unlined tunnels there is no groundwater support pressure, requiring that more emphasis be placed on adequate primary pressure, that is, overburden thickness. Cooling and shrinkage deformations of concrete tunnel linings can lead to contractions approximately double the proof strength of the concrete, leading to cracks or gaps. Grouting can be employed to add the mechanical strength of the rock mass to that of the concrete, thus enabling much higher pressures to be absorbed. Almost double the internal pressure can absorbed with such a design under average site conditions, but such concrete linings have the disadvantage that they are subjected to high levels of continuous tensile stress during operation. (Rochester-IVI)
W86-01277

8B. Hydraulics

DAMMING THE VOLGA CHANNEL AT THE CHEBOKSARY HYDROELECTRIC STATION,
B. M. Erakhtin.
Hydrotechnical Construction, Vol. 18, No. 10, p 465-472, October, 1984. 4 Fig, 7 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 6-12, October, 1984.

Descriptors: *Dam construction, *Hydroelectric plants, *Volga Channel, *Cheboksary hydroelectric station, *USSR, Evaluation, Planning, Construction, Hydraulicking, Berms, Scour.

The Cheboksary hydroelectric station is the fifth and final step of the Volga transport-power cascade. The frontal, pioneer, and bermless methods were examined as possible damming methods. It proved to be technically possible to use the pioneer method for damming large rivers such as this, with erodible channels with depths of 18 m, discharges to 3000-3500 cu m/sec, and a drop of about 60 cm. The economic expediency of such damming should be determined in relation to the cost of stone at the construction site. Damming of large rivers with the use of hydraulicking is possible during intense ice formation. In the case of an erodible channel it is necessary to dump the berm from both banks simultaneously to prevent deep scouring of the bottom. To reduce consumption of stone materials, it is expedient to carry out hydraulic filling of the underwater part of the dam simultaneously with dumping the berm without lagging behind it. In the case of pioneer damming of rivers with an erodible channel, reliable protection of the bottom of the gap is necessary. Protection by a train of stone and rubble with a thickness of 1 m is no guarantee against scouring. The size of the stone of the train should correspond to the velocity in the gap. It should be dumped as an even layer without the formation of mounds. In the case of dumping a berm skeleton composed of large concrete blocks and elimination of the construction of a filter on its upstream slope, the formation of individual washouts at the site of closing the gap, threatening the integrity of the berm, is possible after completing the works. (Baker-IVI)
W86-00987

FLUID AND SEDIMENT INTERACTION OVER A PLANE BED,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W86-01045

BODY-FITTED COORDINATES FOR FLOW UNDER SLUICE GATES,
Alberta Univ., Edmonton. Dept of Chemical Engineering.
J. H. Masliyah, K. Nandakumar, F. Hemphill, and L. Fung.
Journal of Hydraulic Engineering, Vol. 111, No. 6, p 922-933, June, 1985. 8 Fig, 1 Tab, 16 Ref, 2 Append.

Descriptors: *Sluice gates, *Body-fitted coordinates, *Mathematical equations, Flow discharge, Free surfaces, Gates, Velocity, Bed pressure deficit.

A boundary-fitted coordinates method was successfully employed in the evaluation of the discharge coefficients, as well as the free-surface profiles, for vertical and radial sluice gates for an ideal fluid. The values of the discharge coeffi the free upstream and downstream surfac are in good agreement with the literatu details of the flow, such as the velocity pr the bed pressure deficit upstream of the also be predicted accurately. The bound coordinates method was demonstrated viable method in the study of fluid f initially unknown discharge and unkn surface profiles. (Author's abstract)
W86-01046

HEAD-DISCHARGE RELATION FOR SHAFT,
Ecole Polytechnique Federale de Lausa zerland). Chaire de Constructions Hydra
W. H. Hager.
Journal of Hydraulic Engineering, Vol. p 1015-1020, June, 1985. 4 Fig, 1 Ta

Descriptors: *Hydraulics, *Fluid *Vortex shafts, Hydraulic head, Flow, M cal equations, Design criteria.

Vortex shafts (or vortex drops) are verti tures in which fluid flows helically along axis. Compared to the conventional drop they are more favorable regarding the s the fluid and air transfer, and provide a energy dissipation if properly designed. discharge relation of vertical vortex s investigated. Head discharge relation ma resented by a single curve. Typical shaft (flow depth and discharge) depend onl geometry of the shaft inlet. Once these mined immediate determination of the flow characteristics is possible. Maximum flow depth and corresponding maximum are given in order that the flow in th stable and sufficiently aerated. Compa tween the present theoretical approach a vations on model and prototype tests in favorable agreement in the complete ran rameters. No scale effects have been dete proposed equations may be regarded as a head-discharge relation for vortex shafts critical inflow conditions. (Baker-IVI)
W86-01053

COMPARISON OF TWO RIVER DI MODELS,
Hong Kong Univ. Dept. of Civil En
J. H. W. Lee.
Journal of Hydraulic Engineering, Vol. 1 p 1069-1078, July, 1985. 5 Fig, 2 Tab

Descriptors: *River diffusers, *Mat models, Jets, Heated water, Diffusers, effects, Velocity, River flow.

Condenser cooling water flow from steam power generation is sometimes discharge adjacent river as a series of high velo emanating from a multiport diffuser to rapid mixing of the heated effluent with able river flow. A detailed comparison is two analytical river diffuser models: a m accounts for the finite width of the water; and a model that neglects lateral ment. A parametric study reveals remarka difference in the key predictions of the and contraction of the ultimate slipstrea cially with reference to a related recent boundary effects on multiple submerged conclusions are corroborated by detailed measurements in a systematic set of exp covering a wide range of induced flows. IVI)
W86-01093

EFFECT OF PIER SPACING ON AROUND BRIDGE PIERS,
Nottingham Univ. (England). Dept. of Ci neering.
K. R. Elliott, and C. J. Baker.
Journal of Hydraulic Engineering, Vol. 1 p 1105-1109, July, 1985. 4 Fig, 2 Ref.

Descriptors: *Scour, *Bridges, *Piers, S chanics, Flow, Vortices, Hydraulic models matical equations.

ation of scour depth around isolated
ers has been extensively studied in the
scouring process is affected by two proc-
horseshoe vortices around the bases of
will interact with each other and; the
be accelerated by the contraction pro-
the piers. How these two processes affect
ng process is not obvious, and small scale
ts designed to investigate this concern
ducted. During the study mathematical
were presented which considered the
ier spacing on scour depth. These equa-
been derived only for clear water scour,
t of pier geometries, one value of sedi-
(Baker-IVI)

TION OF ALLUVIAL CHANNEL

, Inc., Pasadena, CA.
y bibliographic entry see Field 2J.

RCES ON VERTICAL WALLS,
Wales Univ., Kensington (Australia).
Mathematics.
n.
Waterway, Port, Coastal and Ocean
, Vol. 111, No. 4, p 693-718, July,
3 Tab, 17 Ref.

*Wave action, *Walls, Wave force,
Wave height, Standing waves, Wave
le of incidence, Mathematical studies.

e presented to third order in wave
he force and moment exerted on a
by the complete reflection of waves
rary angle of incidence. These expres-
number of unusual features, some of
been found previously for the special
ing waves. They include the follow-
imum force per unit length is caused
incident waves rather than standing
econd-order contribution to the load
er than that at first order without
he solution; the greatest net force is
offshore under the wave troughs; and
onshore force sometimes does not
wave crests. The formulas presented
oblem of determining the maximum
n purposes one of finding the maxi-
en function in a space which includes
ons the wave height, wave length or
of incidence, and the wall length
e wave-length. (Author's abstract)

VERNING AND SURGING SIMU-

, Kingston (Ontario). Dept. of Me-
eering.

Water Power and Dam Construction,
, p 39-49, June, 1985. 6 Fig, 9 Ref.

Simulation analysis, *Computer pro-
raulics, *Turbines, Hydroelectric
surging, Model studies, Hydraulic
gineering.

g mathematics and the outline of a
ram are presented which should
to compute the hydraulic transients
a load disturbance on a turbine.
sed on water surging equations and
calculations to account for the
uration of a hydropower station in
ks are located in both the headrace
nels. The program has been tested
data of certain hydro plants and has
give a reasonable correlation with
There is some difficulty in adapting
high-head turbines and particularly
ecause of the complex head-flow-
ip. Limitations and potential modi-
computer program are discussed.
ct)

8C. Hydraulic Machinery

CHEREPNOV WATER LIFTER: THEORY AND EXPERIMENT,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
H. Liu, M. Fessehaye, and R. F. Geekie.
Journal of Hydraulic Engineering, Vol. 111, No. 6, p 951-969, June, 1985. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Cherepnov water lifter, *Hydraulics, Hydraulic machinery, Mathematical equations, Computers, Water lifter, Potential energy, Head loss, Pumps.

The Cherepnov water lifter is a novel device to lift or pump water using the potential energy of water. A Cherepnov lifter is similar to a hydraulic ram in that the energy for pumping water comes from water, and that a portion of the inflow must be discharged to a lower place in order to lift the remaining portion of the inflow. The lifter is free of vibration and noise, and has little abrasion of parts. A theoretical and experimental investigation of the hydraulics of the little-known Cherepnov water lifter was conducted. As many as 36 algebraic and differential equations are required to predict the cyclic motion of the flow going through the lifter. With these equations, the behavior of the lifter can be conveniently analyzed on any computer having the Continuous System Modeling Program capability. Accurate predictions can be made using this approach if the head-loss coefficient of each pipe of the lifer is determined accurately. For simplicity, the head-loss coefficients can be assumed without introducing significant errors. Although more research is needed to standardize the lifter design and to evaluate its performance under field conditions, it is felt that enough has been learned to warrant the use of the lifter, at least on a trial basis. It is recommended that a computer simulation of the lifter behavior for each particular design be conducted prior to constructing any lifter. (Moore-IVI)
W86-01048

PUMPS CRUCIAL TO SUCCESS OF LONG-DISTANCE AQUEDUCTS,
McGraw-Edison Co., Mountainside, NJ.
I. Karassik.
Water Engineering and Management, Vol. 132, No. 6, p 35-38, June, 1985. 2 Fig, 1 Tab.

Descriptors: *Water conveyance, *Aqueducts, *Pumps, Water supply, Water transport, Pipelines, Costs.

Pumping technology for long-distance transmission of water is receiving deserved attention as the need to transfer supplies of this essential resource increases throughout the world. In selecting pumps, first costs, construction costs, operating costs, and maintenance must be carefully considered. Some problems in pipeline design are reviewed, including pumping over long distances, and pumping through hilly or mountainous countryside. The number of pump stations that should be installed can be determined based on the pipeline capacity and the route which it is to follow. The possibility of providing multiple units for each station and whether they should be joined in parallel or series must be considered. This analysis must be made on the basis of the range of capacities over which the pipeline will operate throughout its projected lifetime, in conjunction with the total head requirements at these varying capacities. Single-stage or multi-stage pumps are available. (Baker-IVI)
W86-01085

ADVANTAGES OF TURGO-IMPULSE TURBINES IN MICRO-HYDEL UNITS,
Central Electricity Authority, New Delhi (India).
R. K. Grover.
Indian Journal of Power and River Valley Development, Vol. 33, No 1-2, p 7-8, January-February, 1983.

Descriptors: *Turbines, *Impulse turbines, *Francis turbines, *Micro-hydel units, Hydraulic equipment, Mechanical equipment, Design criteria, Planning, Suspended solids.

A point by point comparison is made between the turgo impulse turbine and the Francis turbine. The turgo-impulse turbine is a very simple prime mover. In Francis turbines, the water is admitted through ten to twenty or more openings and controlled by a number of carefully shaped adjustable guide vanes, which is a cumbersome arrangement. In impulse turbines, the runner is set about 1.5 m above the tailwater level, so it rotates in air at atmospheric pressure. In Francis turbines, a seal is a must as the runner rotates in a pressurized chamber. Generally the running water contains suspended matter and solid particles. At high velocity and pressure, this results in wear and tear. In impulse turbines, the parts that wear out are the tip of spear, the nozzle, and after a longer period, the runner. In high head Francis turbines, the suspended particles cause rapid wear and tear. In passing through fine clearances between guide vanes and end-cover facings, and worse still between runner and clearance rings, it can quicky reduce overall effficiency by several percent. One of the major advantages of the impulse turbine is the easy accessibility of various parts for inspection and maintenance. Governing of the unit is also relatively simpler in the case of impulse turbines. The impulse turbine loses to the Francis on three points: low specific speed, head loss due to suction head, and head variation permissible 20% as compared to 25 to 35% in the case of Francis turbines. (Baker-IVI)
W86-01204

PROBLEMS AND PROSPECTS OF POWER EVACUATION MANAGEMENT FROM HYDRO STATION IN HIMALAYAN RANGES,
Uttar Pradesh State Electricity Board, Dehra Dun (India).
T. C. Agarwal, V. N. Rikh, A. K. Gupta, and G. L. Tandon.
Indian Journal of Power and River Valley Development, Vol. 33, No. 3/4, p 87-92, March/April, 1983. 1 Fig.

Descriptors: *Hydroelectric plants, *Himalayas, *Mountainous regions, *Electrical transmission, Transmission lines, Transmission towers, Planning, Construction, Switchyards, Landslides.

The Himalayas have an immense reusable energy potential, which will be tapped by a number of hydroelectric projects, most of which are located deep in the hills. Most of the hydroelectric projects which are either under construction or investigation are located in difficult hilly terrain. Some of these schemes will have very high installed capacities. Location of hydroelectric power stations in such difficult terrain presents problems in the construction of transmission lines. Landslides frequently encountered in Himalayan ranges can result in tower failure. It appears preferable to have single circuit instead of double circuit lines, since in double circuit lines there can be complete outage of both the circuits in the event of tower failure. Proper planning for the routes of transmission lines is essential for ease of construction and maintenance in hill regions. Pooling stations are useful for groups of power stations to keep the step-up voltage at individual power houses low, in order to minimize the switchyard area. The use of bundle conductor lines with special large conductors is recommended for short distances between pooling stations and individual power houses. In cases of installations where flat land is not available for construction of a switchyard, the cost of installing underground gas insulated switchgear can be less than the conventional switchyard. This cost can further be reduced by keeping the SF6 switchyard in the construction adits of underground power houses which become redundant after construction. (Moore-IVI)
W86-01205

MODERN TRENDS IN MANUFACTURING LARGE FRANCIS TURBINE RUNNERS,
National Hydroelectric Power Corp. Ltd., New Delhi (India).
B. S. K. Naidu, and V. K. Gahlot.

Group 8C—Hydraulic Machinery

Indian Journal of Power and River Valley Development, Vol. 33, No. 11, p 386-393, November, 1983. 7 Fig, 3 Tab, 8 Ref.

Descriptors: *Turbines, *Turbine runners, Hydraulic turbines, Hydraulic machinery, India.

The world over, the unit capacities of hydraulic machines used for power generation and pumped storage are increasing day-by-day. The trend of constructing large units has particularly been persisting in the Francis range. With increased unit output, large runners are required to be manufactured and transported. The paper attempts to review the manufacturing involvements, materials, inspection methodology, transport limitations, site fabrication and other related aspects pertaining to the production of large runners (D > 3 m). Integrally cast, split construction, cast welded and stamp welded variants have been discussed with respect to the technology of manufacture, bringing to light the merits and demerits of each. The statistical data of large Francis runners produced by BHEL (Bharat Heavy Electrical Limited) and other leading world manufacturers have been given. Scope of application of such runners in Indian projects is discussed together with BHEL's strategy to meet the country's requirements. (Author's abstract)
W86-01218

ENERGY STORAGE: DEVELOPMENTS IN PUMPED-STORAGE,
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Machines Hydrauliques.
P. Henry, and J. E. Graeser.
International Water Power and Dam Construction, Vol. 37, No. 6, p 13-16, June, 1985. 5 Fig, 1 Tab.

Descriptors: *Energy storage, *Pumped storage, Energy conversion, Electric power production, Electrical equipment, Electric power demand, Engineering, Generators.

Of the methods available for energy storage, pumped storage has been widely preferred as it offers significant advantages. The complete transformation process gives an overall energy output generally higher than 70%; in spite of this the operation is profitable since the cost ratio of slack period and peak period power can be three or even four to one. The concept and history of pumped storage installations in Europe is reviewed. Technological developments are such that the construction of new facilities, particularly in Western Europe, is promising. The possibility of integrating new machines into existing pumped-storage systems makes this type of energy storage economical. Pumped storage will remain the most reliable and economical means of storing large quantities of energy for a relatively long time. (Keenan-IVI)
W86-01272

TESTS ON A FRENCH ADJUSTABLE TWO-STAGE PUMP-TURBINE,
Electricite de France, Chambery. Electrical and Mechanical Div.
N. Roche, D. Lefervre, P. Robert, P. Jarriand, and J. Rondon.
International Water Power and Dam Construction, Vol. 37, No. 6, p 21-25, June, 1985. 12 Fig, 1 Tab.

Descriptors: *Turbines, *Design criteria, *Pump-turbine, Testing, Pumped storage, Hydraulic machinery.

A test program conducted with a prototype pump-turbine with two adjustable stages has provided results that will permit development of high-output pump turbines with two adjustable stages to equip pumped-storage plants with operating heads of more than 1,000 nm. The average-output prototype unit was designed to operate at between 433 and 443 m gross head in both pumping and generating modes and to have an output when generating of 38 MW and when pumping of 33 MW; rotational speed in both modes is 750 revolutions per minute (rpm) and transient speed is 1,170 rpm (generating) or 1,120 rpm (pumping). The unit used two distributors and two 8-blade, stainless steel runners. Tests were made with the two distributors at different openings, and included some of the following conditions: (1) under normal conditions and load rejections in both generating and pumping modes, with distributors synchronized, (2) under normal operations and load rejections in both modes, but with different distributor openings, (3) load rejections with one distributor locked to various opening positions, (4) shutdown and load rejections with spherical valve closure distributors being locked in position (5) back-to-back startup of the machine by one of the Pouget units (35 MW Pelton, 250 MW Francis turbines) to investigate brake-pump and reversed pump rotation quadrants and (6) finalization of dewatering/rewatering sequences and operations as a synchronous condenser in both rotational directions. Testing at the relatively low head Truel (Tarn River, France) site was conducted for convenience, but this Neyrpic-Eketricite de France machine design is intended for employment under heads ranging from 800 to 1,500 m, with a maximal output of about 30 MW per unit. (Rochester-IVI)
W86-01274

8D. Soil Mechanics

EARTHWORKS AT THE INGURI HYDRO-ELECTRIC STATION CONSTRUCTION SITE,
G. Y. Zarandiya, L. S. Babuniya, N. N. Shartava, N. Z. Kolbazov, and U. I. Godzhiashvili.
Hydrotechnical Construction, Vol. 18, No. 8, p 382-389, August, 1984. 3 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 42-47, August, 1984.

Descriptors: *Earthworks, *Dam construction, *Excavation, Tunneling, Hydroelectric plants, Underground structures, Penstocks, Tailrace, Mountainous areas, Roads, Drilling.

At the Inguri hydrostation construction site, the bulk of the earthworks is accounted for by the foundation pit of the 271.5 m high arch dam and underground structures, consisting of the pressure diversion tunnel, five penstocks, two butterfly-valve chambers, the underground powerhouse and the tailrace tunnel. Details of the earthworks associated with the construction of the Inguri Hydroelectric Station are presented. It is recommended that for construction in mountainous areas, the roads leading to the foundation pit should have a minimum of cuts, be constructed on trestles, or pass through tunnels on the slopes. During excavation of the pit it is expedient to construct a concrete support for the finished sections of the pit as the earthmovers descend toward the river channel. During the excavation of the underground structures of the hydrostation, the use of highly productive drilling and mucking equipment and heavy-duty vehicles made it possible to accelerate the construction process. For the excavation of the powerhouse chamber, optimization of the plan for transporting the loosened rock to the surface with the maximum use of all vertical and horizontal accesses promote simplification and acceleration of the operations. (Keenan-IVI)
W86-00984

STRESS-STRAIN STATE OF EARTH DAMS ON UNDERMINED TERRITORIES,
For primary bibliographic entry see Field 8E.
W86-00988

PROVISION OF STABILITY OF UNLINED CANALS,
V. S. Altunin.
Hydrotechnical Construction, Vol. 18, No. 10, p 496-503, October, 1984. 5 Fig, 4 Tab, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 28-32, October, 1984.

Descriptors: *Canals, *Design criteria, Velocity, Sand, Mathematical equations, Model studies, Slopes, Vegetation.

The design and modeling of stable unlined canals in fine sand soils are discussed. The Chezy coefficient for large unlined canals should be determined by special formulas not containing the roughness coefficient. As a first approximation the value of the permissible velocity can be assayed [illegible] consideration of the flow depth. Since canal[s] pletely flowing in fine-sand soils are infreq[uent] found, the development of biological reve[getation] (vegetation) should be encouraged as a me[ans] protecting slopes of unlined canals. (Keena[n]
W86-00992

**MODEL FOR PIPING-PLUGGING IN EA[RTH]
EN STRUCTURES,**
Indian Inst. of Tech., Bombay.
K. C. Khilar, H. S. Fogler, and D. H. Gray, [Jr.]
Journal of Geotechnical Engineering, Vo[l.]
No. 7, p 833-846, July, 1985. 5 Fig, 1 Tab, [refs.]
NSF grant CEE-8313765.

Descriptors: *Piping, *Plugging, *Earth[en]
Clay, Dispersion, Seepage stream, Part[icle]
matter, Model studies, Soil permeability, S[oil]
rosity, Tractive stress, Hydraulic gradient.

A capillary model was developed to predict what conditions piping versus plugging is li[kely] occur as a result of clay particle dispersion i[n]. In the intermediate size range, i.e., particl[es] small per se to clog pore constrictions a[nd] large to wash through unimpeded, the ou[tcome] depends strongly on the concentration of di[s]particles in the seepage stream. This concent[ration] in turn depends upon the rate at which the cles are eroded from the pore walls. The ca[pillary] model was used to ascertain the relationsh[ip] tween key variables at the onset of piping. relationship involved the initial permeabilit[y], porosity of the soil, the critical tractive stre[ss], the hydraulic gradient. The model was also u[sed] predict under what circumstances clay p[article] concentrations in the seepage stream will b[e] suddenly to very high values, a condition fav[orable] to clogging or particle holdup. Results of the ysis showed that very large particle concent[ration] buildups tend to occur at permeabilities of les[s] 10 to the minus 9th power sq cm (0.0001 cm water at 20 C). This prediction is consisten[t] previous findings reported in the geotechnic[al] erature. (Author's abstract)
W86-01087

**NONLINEAR DYNAMIC ANALYSES O[F]
EARTH DAM,**
Princeton Univ., NJ. Dept. of Civil Engine[ering]
J. H. Prevost, A. M. Abdel-Ghaffar, and S. J. Lacy.
Journal of Geotechnical Engineering, Vol[.]
No. 7, p 882-897, July, 1985. 12 Fig, 4 Tab, [refs.]
NSf grant CEE81-20757.

Descriptors: *Earth dams, *Earthquakes, *D[ynam]
ic analysis, Computer models, Stress, Strain celeration, Deformation, Vibration.

Earth dams are large three-dimensional nonl[inear] geneous structures constructed from zoned [earth] tic material; therefore, the computation or p[rediction] tion of their dynamic responses to earthquake ing is extremely difficult. The results of 2D n[onlinear] ear and 3D nonlinear dynamic finite element [analy]ses of an earth dam subject to two very dif[ferent] input ground motions are compared. A compa[rison] between measured and computed earthquak[e re]sponses of the dam is also presented. The stu[dy] based on rigorous nonlinear hysteretic an[alysis] utilizing a multi-surface plasticity theory. backbone shear stress-strain curve is assume[d hy]perbolic and symmetrical about the origin. tailed comparisons of induced stresses, strain celerations, and permanent deformations at va[rious] locations in the dam are presented. Only differences are found between the results o[f the] and 3D nonlinear analyses. The difference somewhat pronounced in the upstream-d[own]stream direction for the strong shaking case study demonstrates the importance of three-di[men]sionality on the dynamic earthquake respon[se of] earth dams, particularly in computing resu[lting] permanent deformations. For the moderate sh[aking] case, there is reasonable good correlation be[tween] the crest acceleration time histories computed the 2D and 3D nonlinear dam models. Some d[iffer]ences are observed for the strong shaking m[otion] in crest acceleration time histories, induced st[rong]

s in the dam material and resulting per-
eformations. The 3D nonlinear analyses
l orders of magnitude more expensive
2D counterparts. The 3D analyses are
ols to account for all possible vibration
the dam and all three components of
aking, to realistically predict the dam
nd to provide longitudinal response pa-
Moore-IVI)

**AL GROUTING IN SOILS PERMEAT-
ATER,**
ern Univ., Evanston, IL. Dept. of Civil
g.
k, and T. Perez.
Geotechnical Engineering, Vol. 111,
8-915, July, 1985. 14 Fig, 3 Tab, 3 Ref.

: *Chemical grouting, *Soil grouting,
gy, Cohesionless soils, Grout injection,
iscosity, Saturated soils, Sand, Gravel.

ata obtained from seventy-nine large-
limensional laboratory tests, limiting
vere established to define the transition
n retention and elutriation and chemi-
jected into a cohesionless soil permeat-
. Various combinations of four grouts,
and one gravel were included in the
program, and the interpretation is
terms of seepage velocity versus gel
ships. The position and extent of the
ne are strongly dependent on the vis-
iscibility of the grout and to a lesser
e effective grain size of the soil. These
re largely responsible for the dilution
nd that, in turn, lengthens the gel time
s the viscosity, thereby governing the
f the injected grout and the resulting
of the soil. Even if a water seal is
he grout may be dissolved or eroded,
r a relatively short time. Measure-
limited number of tests demonstrate
gth is substantially higher in the vicin-
ction point. (Author's abstract)

**YSIS FOR SEISMIC DESIGN OF
AMS,**
eotechnial Engineer, Box 643, Indian
0454.
M. Atkinson, and C. I. Wilmot.
eotechnical Engineering, Vol. 111,
33, July, 1985. 8 Fig, 5 Tab, 29 Ref.

Mine wastes, *Earthquake engineer-
dams, *Risk analysis, Nevada, Liq-
n design, Dam failure, Costs.

eismic risk analysis is a promising
aluating design options and establish-
esign parameters. However, there
examples in the literature to guide
its use. This paper demonstrates the
nalysis for mine tailings dams and
e-history application for a seismical-
on of Nevada. Risk analysis provid-
or selecting among design options
liquefaction resistance, and for es-
t parameters for dynamic analysis.
sented for the quantity and cleanup
released in seismic failures to aid in
pected failure consequences. It is
many tailings dams, accepted life-
obabilities of a few percent may
onable basis for probabilistic deter-
smic design criteria. (Author's ab-

**AL INVESTIGATION OF HY-
CTURING,**
fghanistan). Faculty of Engineer-

B. Singh, and S. S. Saini.
f Power and River Valley Devel-
3, No. 5/6, p 181-187, May-June,
Ref.

Descriptors: *Hydraulic fracturing, *Soil physical properties, Confining stress, Saturated soils, Unsaturated soils.

An experimental investigation has been carried out to study the hydraulic fracturing phenomenon in soils. Cylindrical specimens have been tested under various cell pressures in a triaxial testing apparatus. Internal pressure is gradually applied through a needle inserted axially in the specimen until failure occurs while external pressure is kept constant. Tests are conducted for saturated as well as unsaturated soil specimens. In order to corroborate the experimental results, a theoretical analysis considering linear, elastic behavior of the soil is also carried out. It is considered that hydraulic fracturing will take place when the effective stress in the soil mass is tensile and equals the tensile strength of the soil. Linear relationship of hydraulic fracturing pressure and confining stress is obtained both theoretically and experimentally. The theoretical results show somewhat lower values compared with those obtained experimentally. It is observed that hydraulic fracturing pressure required to cause cracking is more than the confining stress. (Author's abstract)
W86-01207

MANAGEMENT OF MUD, PROBLEMATIC IN THE FOUNDATIONS OF CHANDAN AND GETALSUD EARTH DAMS IN BIHAR (INDIA),
Masan Dam Investigation Div., Bagaha (India).
C. Singh.
Indian Journal of Power and River Valley Development, Vol. 33, No. 9/10, p 309-311, 308, September/October, 1983.

Descriptors: *Earth dams, *Mud, *Chandan Dam, *Getalsud Dam, *India, Soil properties, Dam foundations, Dam construction.

Getalsud Earth Dam across the river Subernarekha in Ranchi District of Bihar was constructed during 1966-69 to intercept 725 sq km of unobstructed catchment of the Subernarekha below Matia Dam for hydel generation and additional water supply to Ranchi township. The mud, found or formed in the foundation of the earth-fill dam was troublesome. The mode of management depended upon the accessibility, the workability, the available time and the extent of security to be ensured. The natural drying, the impregnation of coarse grained heavier materials and squeezing out of excess water by porous material loading were among the main corrective measures practiced in Chandan and Getalsud Earth Dams, in which heavy duty towed scrapers and dozers were intelligently used for removal of mud. In most cases the management of the mud problem lay in heavy earthmoving machinery and not in manual labor. (Baker-IVI)
W86-01213

TECHNOLOGY OF REINFORCED EARTH WALLS,
H.Q.C.E. (P.), Dautak, C/o 99 APO.
G. G. K. Moorthy.
Indian Journal of Power and River Valley Development, Vol. 33, No. 9/10, p 312-319, September-October, 1983. 10 Fig, 5 Tab, 8 Ref.

Descriptors: *Earth dams, *Earthworks, *Reinforced earth, Soil physical properties, Stress, Friction, Strength, Dam construction, Costs.

Reinforced earth is an economical means of improving the mechanical properties of the basic material, earth, by reinforcing it in the directions in which it is subject to the greatest stresses. The essential phenomenon in reinforced earth is the friction between the earth and the reinforcements. Through this friction, the earth transmits to the reinforcements the stresses which develop in the mass; the reinforcements are thereby placed in tension and the result is as though the earth possessed a cohesion in the directions in which the reinforcements are placed. This cohesion which is generated is directly proportional to the tensile strength of the reinforcements. The soil used in a reinforced earth structure should meet certain minimum criteria to ensure the development of sufficient friction between the earth and the reinforcements, and to ensure that no interstitial pore water pressures develop within the reinforced earth structure. The size, spacing and length of reinforcing strips are determined by calculation of internal stability of the reinforced earth structures. The flexibility of the reinforcing strips and their tensile strength are the essential elements in these calculations. The service life of a reinforced earth structure depends primarily on the resistance of the reinforcing strip to soil corrosion. Costs of reinforced earth construction are briefly considered along with advantages to using the reinforced earth technique for dam construction. (Baker-IVI)
W86-01214

8E. Rock Mechanics and Geology

WAYS OF USING THE BEARING PROPERTIES OF A ROCK MASS WHEN DESIGNING UNDERGROUND HYDRAULIC STRUCTURES,
V. F. Ilyushin.
Hydrotechnical Construction, Vol. 18, No. 8, p 357-364, August, 1985. 4 Fig, 7 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 21-25, August, 1984.

Descriptors: *Rock mechanics, *Design criteria, *Hydraulic structures, *Underground structures, Construction, Rock properties, Site selection, Geology, Linings, Coatings, Seismicity, Pressure, Groundwater.

One of the main principles of developing economic layouts and designs of underground hydraulic structures is the use of the bearing properties of the surrounding rock mass. With consideration of the available design, construction, and operating experience and tendencies toward an improvement of underground hydraulic structures, a number of general and particular directions can be followed. One of the first stages is the analysis of the engineering-geologic conditions of the construction territory and selection of the site of the underground hydraulic structure. Measures should be taken to make the best use of the rocks, including: artificial stabilization of rocks; efficient structure layout; use of shapes which are the most stable under the given conditions; and the use of linings and coatings. Seismic factors must also be taken into account. Laboratory investigations should be conducted on large-scale and two- as well as three-dimensional models permitting a reliable determination of the stress-strain state of the structure. Driving technology can be used to provide minimum disturbance of the rocks in the vicinity of the working. Inspection during and after construction is essential for underground structures. A number of underground hydraulic structures along with examples are given: structures experiencing rock pressure; pressure structures absorbing groundwater pressure; and outlet structures. (Shieh-IVI)
W86-00982

GENERALIZED RELATIONS BETWEEN STATIC AND DYNAMIC INDICES OF ROCK DEFORMABILITY,
A. I. Savich.
Hydrotechnical Construction, Vol. 18, No. 8, p 394-400, August, 1984. 5 Fig, 2 Tab, 15 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 50-54, August, 1984.

Descriptors: *Deformation, *Rock properties, Seismic properties, Acoustic properties, Elasticity, Rock testing, Rock mechanics.

Seismic acoustic methods have been used to study the elastic and deformation properties of rock masses. The correlation between the characteristics of the medium determined in the seismic acoustic investigation and the indices of its deformation properties (the static modulus of elasticity and modulus of deformation) are the basis of a quantitative evaluation fo the indices of rock deformability. When solving many problems in practice, the deformation properties of rocks in their natural occurrence can be determined with sufficient accuracy from the data of seismic acoustic measurements

without conducting labor-intensive and costly static tests. (Keenan-IVI)
W86-00985

STRESS-STRAIN STATE OF EARTH DAMS ON UNDERMINED TERRITORIES,
V. F. Markevich, V. I. Teleschev, and A. K. Bugrov.
Hydrotechnical Construction, Vol. 18, No. 10, p 472-477, October, 1984. 3 Fig, 10 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 12-15, October, 1984.

Descriptors: *Mining, *Dam stability, *Earth dams, *Foundation failure, Dam failure, Construction, Dams, Embankments, Stress, Strain, Deformation, Tension cracks.

Underground mining causes deformations of the ground surface and affects engineering structures falling in the zone of influence of mining operations. Detection of the possibility of undermining of the foundations of earth dams is related to an investigation of their stress-strain state in the presence of deformations of the foundation being undermined, establishment of the limit values of these deformations, and development of special protective measures ensuring the normal operation of the dams in the presence of deformations exceeding the limit. A method is proposed for calculating the stress-strain state of earth dams and embankments located on foundations being undermined. As a result of the mathematical investigations the characteristics of the development of limit equilibrium zones and changes in all components of the stress-strain state were stablished. A substantial effect of the curvature of convexity of the foundation was found and the values of the limit strains of the foundation for homogeneous dams of cohesive soils with a dam height of 10-30 m were estabished. The occurrence of tension cracks in earth dams during undermining of the foundations represents an additional danger in connection with the fact that they are concentrators leading to the development of strains and eventually to growth of the crack. (Baker-IVI)
W86-00988

ELASTIC DEFORMATION OF THE FOUNDATION OF THE BRATSK CONCRETE DAM,
V. G. Ivanov.
Hydrotechnical Construction, Vol. 18, No. 10, p 492-495, October, 1984. 2 Fig, 1 Tab, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 25-27, October, 1984.

Descriptors: *Deformation, *Dam foundations, *Settlement, Concrete dams, Reservoir operation, Bench marks, Rock mechanics, Elastic deformation.

Measurements of settlement of structures at the Bratsk hydroelectric station have been conducted since the start of filling the reservoir (September 1961). Analysis of the data yielded several results. Recommendations are made regarding the required degree of accuracy in measuring settlement. After filling the reservoir, more accurate methods become necessary. It is necessary to consider whether near-by bench marks are in the zone of deformation of the rock foundation. If so, this will distort the results. At this hydrostation with relatively small drawdowns of the reservoir it was possible to detect elastic behavior of the rock foundation of the dam. (Keenan-IVI)
W86-00991

SIMPLIFIED EARTHQUAKE ANALYSIS OF CONCRETE GRAVITY DAMS: SEPARATE HYDRODYNAMIC AND FOUNDATION INTERACTION EFFECTS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W86-01080

SIMPLIFIED EARTHQUAKE ANALYSIS OF CONCRETE GRAVITY DAMS: COMBINED HYDRODYNAMIC AND FOUNDATION INTERACTION EFFECTS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W86-01081

INVESTIGATION OF DAM SITES: MODERN PRACTICES,
National Hydroelectric Power Corp. Ltd., New Delhi (India).
V. Ram, and S. K. Roy.
Indian Journal of Power and River Valley Development, Vol. 33, No. 9/10, p 278-281, September-October, 1983. 3 Ref.

Descriptors: *Dam foundations, *Site selection, *Reservoir siting, India, Planning, Evaluation, Dam construction, Decision making.

Methods currently in use in developed countries for reconnaissance and investigations of rock foundations for large dams are reviewed. The various in situ investigation methods in practice in European countries include: structural geology survey; graphical presentation of structural geology; geophysics; petite sismique; rock quality designation; Lungeon test; and Jacking test. Some of the methods are already in use in India, while some can be suitably modified according to Indian conditions. Stress should be laid on investigation methods which are expeditious and yield reliable results so that hydel projects which have a longer gestation period in India can be commissioned within 6-8 years instead of 10-15 years which is the case for many of the ongoing projects. Accuracy of the investigation is also desired so that the predictions made by geologists are not unreliable which sometimes leads to serious construction problems not anticipated originally and leads to adoption of a new method of construction, increasing the quantum of work, thus leading to an increase in estimated costs and extending the construction schedule. (Baker-IVI)
W86-01210

MECHANIZED TUNNELLING - A LANDMARK IN INDIAN TUNNELLING PRACTICE,
National Hydroelectric Power Corp. Ltd., New Delhi (India).
For primary bibliographic entry see Field 8A.
W86-01216

8F. Concrete

ON-SITE TESTS OF A NEW TYPE OF TUNNEL LINING AT THE NUREK HYDROSTATION CONSTRUCTION SITE,
V. V. Rukin, and V. L. Kuperman.
Hydrotechnical Construction, Vol. 18, No. 8, p 345-356, August, 1984. 13 Fig, 19 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 13-20, August, 1984.

Descriptors: *Tunnel linings, *Linings, *Latex concrete, Concrete technology, Elasticity, Deformation, Strength, Tunnels.

The maximum use of the bearing capacity of the rock mass is one of the principal ways to reduce the thickness of linings of hydraulic pressure tunnels. A new material, latex concrete, can be used to allow the rock to absorb the load from the internal pressure of the water because it can provide the necessary yielding and elasticity at a high tensile strength. The addition of synthetic styrene-butadiene latex SKS-65GP to the concrete mix in the amount of about 10% of the dry weight of the cement leads to a decrease of the modulus of deformation of concrete by more than two fold. The addition of latex to concrete makes it possible to reduce the water/cement ratio and to improve the technological properties of the concrete mix - fluidity, plasticity, and workability. Latex concrete can be prepared in ordinary concrete mixers and does not cause additional difficulties in concrete works. Large-scale investigations in an experimental gallery of tunnel 9-TTs at the Nurek hydrostation construction site were undertaken to obtain the data on the work of a tunnel with latex concrete in contact with massive rock and to perfect the technological parameters of concreting. The high elasticity of the latex concrete in comb
with its increased ultimate tensile strength
possible to reduce the thickness of latex c
linings compared with ordinary concrete
least half. For the permanent headrace tu
the Nurek hydrostation show that the use
latex concrete makes it possible to dispen
reinforcement of the lining and to use co
tion grouting of the rock with a total savin
million rubles. In the near future latex c
will be used in the linings of hydraulic str
(pressure tunnels) at a number of instal
(Shieh-IVI)
W86-00981

**USE OF CAST-IN-PLACE CONCRETE TE
RARY SUPPORT IN HYDRAULIC TUN**
M. G. Bikineev, and B. D. Mal'tsev.
Hydrotechnical Construction, Vol. 18, N
364-370, August, 1984. 3 Fig, 6 Ref. Tra
from Gidrotekhnicheskoe Stroitel'stvo, N
25-29, August, 1984.

Descriptors: *Concrete technology, *Cast-i
concrete, *Concrete temporary support, *T
Construction, Linings, Hydroelectric plants.

The cast-in-place concrete temporary
(CTS) constructed by means of traveling
work can be used to solve problems of
acutely scarce metal (metal arches) and to p
safe underground working conditions in
stable rocks. Two types of CTS are currentl
a support capable of performing the func
permanent lining and a support contructed
period prior to the construction of per
lining. The CTS has been used in a num
hydrostation projects. The use of CTS is
mainly to determination of weak stability
tions of the rocks being tunneled. The possib
rockfalls depends not only on the strength
rock mass but also on the cross-sectional sha
span of the tunnel and length of its unsup
section. Therefore, the selection of the l
distance of the CTS from the face is imp
The reliability of the CTS is also determi
the forces of the bearing pressure of the ro
the arch on the rocks in the tunnel face and
constructed support behind the face. The CT
be used in rocks with a strength coefficie
than 2 and specially in zones of tectonic de
tions. The stability of the rocks should be e
ed and analog methods as well as laboratory
eling should be used. Moreover, additional
tory and on-site investigations are needed f
veloping calculations for CTS and the constr
technology. (Shieh-IVI)
W86-00983

**EVALUATION OF THE STRENGTH AN
FORMABILITY OF CONCRETE OF MAS
HYDRAULIC STRUCTURES,**
V. M. Vlasov, V. I. Veretyushkin, L. M. Deryugin, and A. S. Moiseenko.
Hydrotechnical Construction, Vol. 18, No.
478-484, October, 1984. 2 Fig, 3 Tab, 8 Ref.
lated from Gidrotekhnicheskoe Stroitel'stvo
10, p 15-19, October, 1984.

Descriptors: *Strength, *Concrete techno
Hydraulic structures, Core tests, Cube tests,
tests, Deformability.

When evaluating the quality of concrete o
basis of core test data there is some difficu
converting to strength of standard cube and
test specimens. This conversion is influenc
the scale effect, aggregate size, effect of the b
ary conditions of load application, geometry
specimen, technology of preparing the speci
and moisture content of concrete. An evaluati
the effects of all of the factors separately o
strength and deformability of concrete of a ma
structure is a difficult problem; the accuracy
evaluation will be low, because of interacti
the factors. Based on a comparison of core
data and standard test speciments, equation
developed for the conversion. The overall po
decrease of the calculated strength due to
interaction of weak and strong regions o
concrete layers of a massive structure will be

ldditional reserve of strength should be taken ccount at the design stage. (Keenan-IVI) 0989

ALTIC CONCRETE LININGS FOR ED-STORAGE RESERVOIRS,
Bau-A.G., Cologne (Germany, F.R.).
Geiseler, and W. Kuhlmann.
tional Water Power and Dam Construction, No. 6, p 17-20, June, 1985. 8 Fig, 4 Ref.

tors: *Reservoirs, *Linings, *Asphaltic e, Asphalt, Construction, Sealants, Slope.

of performance and inspection results for c-concrete linings in pumped-storage reser- Waldeck II and Glems (Federal Republic any), Ludington, Michigan, and Coo I and ium) demonstrates that this type of sealing ormed well. Large areas of the linings on rvoir bottom and slope required only very aintenance work. Failures that did occur und at joints between the asphaltic-con- ng and a concrete abutment (Glems), as a f motion of an intake structure, which he lining to fold as it was moved by the to which it was attached (Ludington), e joint between the intake structure and unding lining (Coo). In all four reservoirs, f the lining itself were limited to minor d occasional bubbles. Special attention in nd construction should be given to the ween the bituminous lining and concrete s. The initial impounding should be car- lowly enough to allow the various struc- materials to adapt to changing condi- gular inspection of asphaltic-concrete lin- ill necessary, however, and any defects e repaired immediately. (Rochester-IVI) 73

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CONDUITS FOR HIGH-HEAD

Univ. (Austria). Inst. fuer Konstruktiven und Tunnelbau.
ry bibliographic entry see Field 8A.
7

neries Engineering

OF REDUCED DISCHARGE ON TION AND DISTRIBUTION OF AGE- OW TROUT IN SEMINATURAL LS,
v., Dunedin (New Zealand). Dept. of

mer.
ns of the American Fisheries Society, No. 3, p 388-396, May, 1985. 3 Fig, 5 f.

: *Ecological effects, *Stream dis- rout, *Fish behavior, Fish migration, , Growth, Production, Migration, avior, Population density.

of reduced discharge on emigration, growth, production, and distribution of ng rainbow trout, Salmo gairdneri, ed in small, seminatural experimental New Zealand. Three stream channels t discharges of 0.125 cu m/s from mid- spring in southern hemisphere) to mid- Discharge was then reduced in two ut remained unchanged in the third. f discharge by 32% (to 0.085 cu m/s) (to 0.050 cu m/s) caused no increase in emigration, the emigration rate imme- re reduction being 0.1-0.7 fish/d and nths after reduction being 0.0-0.3 fish/ , the results may have been influenced population sizes in the channels before es were altered. Presumably, these dif- re caused by unequal hatching success ted in the channel substrates. Popula- was greatest (41/100 sq m) in the cted for control discharge. Following discharge alteration, this pattern continued (lowest discharge: 21/100 sq m; control: 7/100 sq m). Fish size differences between channels at the end of the experiment (7 July) were in direct relation to channel discharges and in inverse relation to population density (largest fish in the control and smallest fish in the low discharge channel). Reductions in instantaneous growth rates were attributable to reduced discharge, but occurred about 2 months after discharge reduction. Reduced discharge depressed production after about 1.5 months and by the end of the experiment there had developed a direct relationship between discharge and production; production was 1.4 g/100 sq m at 0.125 cu m/s and -3.8 g/100 sq m at 0.050 cu m/s. There were no significant differences among the channels in the distribution of fish among riffle, pool, and run habitat types. Before discharge reduction, fish in all channels occurred mostly in the riffles and, after reduction, fish in control and treated channels became progressively more evident in the pools. Discharge reduction had no effect on this distribution. (Author's abstract)
W86-01150

SWIMMING PERFORMANCES OF THREE RARE COLORADO RIVER FISHES,
Utah Cooperative Fishery Research Unit, Logan.
C. R. Berry, Jr., and R. Pimentel.
Transactions of the American Fisheries Society, Vol. 114, No. 3, p 397-402, May, 1985. 1 Fig, 2 Tab, 40 Ref.

Descriptors: *Colorado River, *Fish, *Fish behavior, *Fish swimming ability, Entrainment, Fish physiology, Squawfish, Chubs, Animal behavior, Water temperature.

A stamina tunnel was used to determine the prolonged swimming performance of age-0 humpback chubs (Gila cypha), bonytail chubs (G. elegans), and Colorado squawfish (Ptychocheilus lucius) and of subadult Colorado squawfish. The 'fatigue velocity' in body lengths per second at which 50% of the test fish were fatigued (FV50) was determined at 14, 20, and 26 C. The range of FV50 values for the three fishes (average total length in parentheses) were: humpback chubs (95 mm), 4.4-5.7: bonytail chubs (99 mm), 4.7-5.8; small Colorado squawfish (104 mm), 4.0-4.5; large Colorado squawfish (432 mm), 2.0-2.3. Absolute speed of large Colorado squawfish was about 2.4 times that of small Colorado squawfish. Swimming ability of the subyearlings increased with increased water temperature. These rare fish had prolonged-swimming abilities similar to other fish species. (Author's abstract)
W86-01151

MORTALITY OF JUVENILE AMERICAN SHAD AND BLUEBACK HERRING PASSED THROUGH A LOW-HEAD KAPLAN HYDROELECTRIC TURBINE,
Massachusetts Cooperative Fishery Research Unit, Amherst.
R. E. Taylor, and B. Kynard.
Transactions of the American Fisheries Society, Vol. 114, No. 3, p 430-435, May, 1985. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Turbines, *Mortality, *Shad, *Herring, Fish migration, Hydroelectric plants, Lowhead hydropower, Cavitation, Controlled surface sillage, Fish behavior.

The objectives of this study were to determine the immediate turbine induced mortality of juveniles at a lowhead hydropower facility during natural downstream migration and to test for differences in fish mortality associated with three levels of electrical generation. Turbine induced mortality was estimated at 62% for the 16.5 MW mode of generation, and 82% for both the 12.0 MW and 5.5 MW modes. There were no significant differences in the recovery rates for prekilled fish or control fish among treatments, but there were for test fish. Recovery of test fish increased with electrical output of the turbine. Cavitation is thought to be the most important source of mortality to juvenile fish passed through Kaplan turbines. Whether or not controlled surface sillage at a dam would be an effective method of bypassing juveniles around the turbines is not known but preliminary indications are encouraging. Also, the peak in daily movement of juvenile American shad is between 1800 and 2000 hr EST during outmigration. This could minimize mortality because the turbines are typically under moderate to heavy loads at night and are usually running at the 26.5 MW generation mode. (Baker-IVI)
W86-01155

SIMULATING FISH REDISTRIBUTION IN THE LG-2 RESERVOIR AFTER FLOODING,
Sherbrooke Univ. (Quebec). Dept. of Chemical Engineering.
K. A. Morrison, N. Therien, and B. Coupal.
Ecological Modelling, Vol. 28, No. 1/2, p 97-111, May, 1985. 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Fish populations, *Model studies, *Reservoirs, *Fish behavior, *Reservoir fisheries, *Flooding, *LG-2 Reservoir, *La Grande Hydroelectric Complex, *Quebec, Reservoir operation, Fisheries management, Species distribution, Fish migration, Populations, Animal behavior.

The changes that occur to fish movements and distributions as a result of the flooding of a large reservoir are not well known. Some of the mechanisms causing such changes can be identified. A model was developed of the movements of fish populations in the LG-2 reservoir of the La Grande Hydroelectric Complex in Quebec over the 2 years following innundation. The only processes examined by the model are dilution and depth changes. The purpose of the model is to provide approximate estimates of what would occur to observed fish catches if these were the only processes going on; the model thus provides a null hypothesis against which experimental data can be compared to evaluate the importance of the other processes affecting fish distributions during and immediately after flooding. Two species are examined, the walleye (Stizostedion vitreum) and the longnose sucker (Catostomus catostomus), and results were compared to observations. The only processes examined by the model are dilution and depth changes. Population distributions and water depth were plotted using a three-dimensional graphing system. The model predictions are fairly close after the 1st year but diverge from observations at several stations after the 2nd year. This divergence may be due to the adaptation of the populations to new spawning areas, a factor not yet considered in the model. One area requiring more research is habitat preference of deeper-water species. The model is also simplistic in that it does not allow for seasonal changes in habitat preferences. Movements to spawning areas fall within this set of factors. The inclusion of these effects will allow the model to make more realistic projections into the future, and will allow some examinations of the influences of the managed bays on fish distributions. (Collier-IVI)
W86-01166

GROWTH RATE OF YEARLING COLORADO SQUAWFISH AT DIFFERENT WATER TEMPERATURES,
National Fisheries Center-Leetown, Kearneysville, WV.
For primary bibliographic entry see Field 6G.
W86-01169

9. MANPOWER, GRANTS AND FACILITIES

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WATER RESOURCES ENGINEERING EDUCATION,
Virginia Water Resources Research Center, Blacksburg.
For primary bibliographic entry see Field 6B.
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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 19, NUMBER 5
MAY 1986

-- W86-01919
SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1986.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
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05 WATER QUALITY MANAGEMENT AND PROTECTION

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ROLOGY OF MID-ALTITUDE TUSSOCK SSLANDS, UPPER WAIPORI CATCH-T: II - WATER BALANCE, FLOW DURA-N AND STORM RUNOFF,
Zealand Forest Service, Rotorua. Forest Re-h Inst.
Pearce, L. K. Rowe, and C. L. O'Louglin.
al of Hydrology (New Zealand), Vol. 23, No. 0-72, 1984. 5 Fig, 1 Tab, 11 Ref.

iptors: *Storm runoff, *Grasslands, *Hydro-models, *Upper Waipori Catchment, *New nd, Flow, Rainfall, Vegetation, Interception, piration, Groundwater storage, Quickflow.

balances over 3 years in two catchments in unmodified narrow leaved snow tussock te that evaporative losses are substantially r than would be predicted from Penman or methods of estimation. Runoff, particularly d runoff, is high in comparison with other tive covers in either similar or substantially rainfall climates. Interception losses, at 20% of gross rainfall, are somewhat higher nticipated for vegetation of this type and , and are comparable with scrub vegetation density forest stands. Transpiration on a monthly, or annual basis, except in winter , is much less than would be predicted by n's or Priestley and Taylor's equation. The anspiration values are also consistent with served high, persistent rates of delayed from shallow, unconfined groundwater stor-dicating that upward fluxes of soil water to ration do not compete effectively with e of the groundwater to delayed runoff. unoff responses are moderate and are com-to areas of indigenous forest with similar climates in terms of the ratio of quickflow n rainfall over a wide range of event sizes. ow as a proportion of total runoff is less most areas studied in detail in New Zea-t this reflects the persistence of high rates ed flow, rather than small yields of quick-simple conceptual model of daily water with an interception store and regolith scharged by transpiration and drainage is of fitting the major components of the alance to a precision of better than 10%. del, however, does not identify precisely hanisms by which either quick flow or runoff are generated. (Baker-IVI)
84

PTUAL RUNOFF MODEL FOR A TAINOUS RAIN-ON-SNOW ENVIRON-CRAIGIEBURN RANGE, NEW ZEA-

ury Univ., Christchurch (New Zealand). Geography.
oore, and I. F. Owens.
f Hydrology (New Zealand), Vol. 23, No. 9, 1984. 6 Fig, 4 Tab, 22 Ref.

ors: *Runoff, *Model studies, *Snow, *New Zealand, *Craigieburn Range, ion, Storm seepage, Air temperature, Es-Snowmelt, Wind.

model incorporating a distributed snow nd a lumped transformation routine was d for conditions in non-glacierized moun-asins in the eastern South Island of New and was applied in the Camp Stream t. A major problem was the overestima-unoff. The magnitudes of the water-bal-ponents in the South Island mountain particularly evaporation and subsurface flow, should be investigated to improve l. Mean daily air temperature is inad-discriminating rain from snow at eleva-er than about 1500 m. Precipitation and re data with a resolution of three hours y be required to simulate snow accumu-rther modelling work on this environ-uld include distributed transformation routines and the refinement of snowmelt indices. In particular, the use of alternative wind-speed indices, such as wind speeds from upper air-pressure, should be explored. (Baker-IVI)
W86-01386

RECURRENCE INTERVAL OF DROUGHT EVENTS THROUGH STOCHASTIC ANALYSIS OF RAINFALL AND STREAMFLOW DATA,
Melbourne Univ., Parkville (Australia). Dept. of Civil Engineering.
R. Srikanthan, and T. A. McMahon.
Hydrological Sciences Journal, Vol. 30, No. 2, p 197-206, June, 1985. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Drought, *Recurrence intervals, *Rainfall, *Streamflow, *Stochastic hydrology, *Victoria, *Australia, Temporal distribution, Model studies, Data interpretation.

The efficient management of an agricultural system or the operation of a water supply scheme requires knowledge about critical droughts, such as their length, severity and frequency of occurrence. Several theoretical distributions are fitted to drought events of up to one year's duration and the average recurrence intervals calculated. A methodology based on stochastically generated data is proposed and used to obtain the average recurrence intervals of events of duration longer than one year. These methods are applied to five river basins in Victoria, Australia. The accuracy of the method is dependent on the adequacy of the generating model. (Author's abstract)
W86-01444

PROBABILITY-DISTRIBUTED PRINCIPLE AND RUNOFF PRODUCTION AT POINT AND BASIN SCALES,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W86-01449

GENERATION OF DELAYED PEAKS IN STREAM DISCHARGE,
Oxford Univ. (England). Geography School.
T. P. Burt, and D. P. Butcher.
Journal of Hydrology, Vol. 78, No. 3/4, p 361-378, June, 1985. 13 Fig, 1 Tab, 25 Ref.

Descriptors: *Storm seepage, *Stream discharge, *Delayed peaks, Flood peaks, Computer models, Simulation, Slopes, Soil water, Rainfall, Runoff, England.

Where deep permeable soils overlie impermeable bedrock and where steep hillslopes border a narrow floodplain, subsurface stormflow dominates the hydrograph. In such cases delayed peaks in stream discharge may occur several days after rainfall, providing the major volumetric response and possibly also the highest peak discharge. The general occurrence of such delayed peaks is considered, making reference to field data from two small drainage basins in southwest England, and to the results of computer simulations using a distributed hillslope model. The importance of soil-water convergence into hillslope hollows is stressed. The relative roles of rainfall and antecedent soil moisture in controlling the size and timing of the delayed peak is discussed. The implications of the results for hillslope runoff modelling are briefly considered. (Author's abstract)
W86-01480

MACROSCOPIC ESTIMATION OF AVAILABLE WATER RESOURCES IN KAGOSHIMA PREFECTURE, JAPAN (IN JAPANESE),
Kagoshima Prefectural Office (Japan). Planning Dept.
Y. Osako, T. Tsuyuki, S. Koriyama, and K. Hyakumoto.
Reports of the Faculty of Science, Kagoshima University, No. 17, p 89-101, December, 1985. 5 Fig, 7 Tab, 8 Ref.

Descriptors: *Water resources, *Kagoshima, *Japan, *Hydrologic cycle, Groundwater, Surface water, Precipitation, Runoff.

Proper planning for the development and management of water resources requires the quantitative estimation of available water including surface and ground water. A method of macro-estimate of available water resources is presented using rainfall, streamflow and evaporation data accumulated by Kagoshima Weather Bureau and Kagoshima Prefectural Office. In general, precipitation minus evaporation equals streamflow plus percolation. As percolating ground water ultimately reaches streams, quantities of water resources or surface runoff are calculated by annual precipitation minus evapo-transpiration. Compared with measured stream flow data, those calculated figures are rather large. This is presumably due to the nonuniform distribution of precipitation by orographic effect. The average annual runoff coefficient of rivers in Kagoshima Prefecture is 0.65. To estimate the safe yield, the annual low precipitation and runoff data in 1942 are selected to be expected to occur once every ten years. Rivers in Kagoshima Prefecture can be classified into four types by unit flow states (illustrated in tables). Each type of rivers reflects the geologic conditions of their drainage basins. Rivers of type I are characterized by very stable flow states through the year. Pyroclastic flow deposits or so-called shirasu are widely distributed in the basin of rivers of type I. Under a natural flow state, ratios of quantities of available surface water to total runoff in each type of river are 48.0%, 34.0%, 24.0%, and 18.0% respectively. Calculated quantities of available water under a natural flow state in Kagoshima Prefecture are given. (Author's abstract)
W86-01604

MAXIMUM LIKELIHOOD PARAMETER ESTIMATION OF HYDROLOGIC SPATIAL PROCESSES BY THE GAUSS-NEWTON METHOD,
Iowa Inst. of Hydraulic Research, Iowa City.
P. K. Kitanidis, and R. W. Lane.
Journal of Hydrology, Vol. 79, No. 1/2, p 53-71, July, 1985. 2 Fig, 2 Tab, 26 Ref. Department of the Interior project CT 381702, NSF grant CME-8106577.

Descriptors: *Maximum likelihood, *Parameter estimation, *Hydrology, Mathematical studies, Spatial properties, Gauss-Newton method, Optimization.

The Gauss-Newton method for maximum likelihood (ML) parameter estimation of spatially correlated hydrologic fields is described with emphasis on computational aspects associated with its implementation. The essence of the Gauss-Newton method is that, for purposes of applying Newton's optimization method, the Hessian of the function to be minimized is replaced by its average value eliminating the need to calculate second derivatives. In ML estimation, the parameters are determined through minimization of the negative log-likelihood function and the average of the Hessian is known as the information matrix. The information matrix provides a lower bound to the covariance matrix of parameter estimation error. Methodologies to account for near-singular information matrix and to enforce lower or upper bounds in the parameters are described. A general method to eliminate the bias in covariance parameter estimates caused by unknown drift parameters is also presented. Some simple examples are presented to illustrate the potential advantages of Gauss-Newton. The conditions under which this method should perform well are also discussed. (Author's abstract)
W86-01656

CORRELATION BETWEEN SAMPLE FIRST AUTOCORRELATION COEFFICIENT AND EXTREME HYDROLOGIC RUNS,
George Washington Univ., Washington, DC. International Water Resources Inst.
V. Yevjevich, and J. T. B. Obeysekera.
Journal of Hydrology, Vol. 79, No. 1/2, p 171-186, July, 1985. 9 Fig, 9 Tab, 15 Ref. NSF grant CEE-8405289.

Group 2A—General

Descriptors: *Runoff, *Autocorrelation, *Hydrologic series, Drought, Hydrologic models, Water demand, Autoregression.

Differences between the annual runoff series, as the systems water supply and the annual output series, as the systems water demand, define various types of runs. The extreme runs of samples of these differences are positively correlated with the parameters of series dependence in general, and series first autocorrelation coefficient r1, estimated from these samples, in particular. This correlation is made between the estimated r1 and each of the three variables of sample extreme runs. These variables are defined as summations of n longest or largest positive and longest or largest negative sample extreme runs. The resulting regression equations of r1 versus these variables permit an alternative estimation of rho 1, if this estimate is needed for any purpose. As expected, these correlations are always positive and relatively high. To show how high these correlations are, two models are used to generate samples of different sizes with various population p1 values and to study the resulting correlation: (1) first-order autoregressive normal process; and (2) dependent lognormal process, obtained by the exponential transformation of the first-order autoregressive normal process. (Author's abstract)
W86-01666

WATERSHED COMPUTER MODELS,
Flaherty-Giavara Associates, New Haven, CT.
J. G. MacBroom.
Journal of the New England Water Works Association, Vol. 99, No. 2, p 187-199, June, 1985. 4 Fig.

Descriptors: *Computers, *Model studies, *Watershed management, Simulation, Water supply development, Water resources, Water management, Reservoir operation.

Two types of computer models are described that are useful tools for analyzing water supply reservoirs and dams. The use of watershed computer models is of particular importance to water supply utilities that depend on surface water reservoirs for raw water, and who are responding to increased demand for dependable supplies. In addition, computer models are critical for evaluating low flow conditions downstream of reservoirs, hydropower potential at reservoirs, and dam safety. The first type discussed in a continuous simulation model that mathematically represents the flow and storage of water over an extended period of time and is commonly used to determine safe yields. The second model mathematically simulates a single rainfall event, and is typically used to evaluate flood flows and spillway capacity at dams. The watershed computer models represent a major improvement in the ability to plan, manage, and operate water supply reservoirs. The use of calibrated computer models is vital in gaining a better understanding of reservoir operations, limitations, and potential development of resources. (Baker-IVI)
W86-01754

DETERMINATION OF GROWING SEASON SOIL WATER DEFICITS ON A FORESTED SLOPE USING WATER BALANCE ANALYSIS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
D. G. Giles, T. A. Black, and D. L. Spittlehouse.
Canadian Journal of Forest Research, Vol. 15, No. 1, p 107-114, February, 1985. 5 Fig, 4 Tab, 38 Ref.

Descriptors: *Soil water, *Soil moisture deficiency, *Forests, *Hydrologic budget, Slopes, Solar radiation, Air temperature, Rainfall, Root zone, Storage capacity, Elevation, Evapotranspiration.

Coefficients for the calculation of soil water balance components at seven sites on a forested slope were determined using only measurements of daily solar irradiance, maximum and minimum air temperature and rainfall, and weekly root zone soil water content during a 2-year period. Site parameters required were root zone depth, soil water retention characteristics, and rainfall interception coefficients. Based on daytime net radiation, the Priestley-Taylor evapotranspiration coefficient (alpha) was found to be 0.73 +/- 0.07, which is similar to values reported in other conifer forest studies. Growing season water deficit increased with decreasing root zone water storage capacity, which was mainly a function of root zone depth. A comparison between high and low elevations on the slope showed 100-year site indices ranging from 17 to 53 m corresponding to growing season soil water deficits during the driest year of the study, ranging from 79 to 4 mm. Basal area annual increments were found to be correlated with soil water deficits and growing season transpiration, both for the study period and when both variables were averaged over the last 18 years. (Author's abstract)
W86-01786

2B. Precipitation

CONCEPTUAL RUNOFF MODEL FOR A MOUNTAINOUS RAIN-ON-SNOW ENVIRONMENT, CRAIGIEBURN RANGE, NEW ZEALAND,
Canterbury Univ., Christchurch (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W86-01386

YEAR OF WORLD WIDE EXTREMES; FLOODS AND DROUGHTS,
National Environmental Satellite, Data, and Information Service, Washington, DC. Climate Assessment Branch.
D. LeComte.
Weatherwise, Vol. 37, No. 1, p 8-11, 15-17 and 19, February, 1984. 10 Fig.

Descriptors: *Weather patterns, *Drought, *Floods, Rainfall, Storms, Climate, Heat, Cold, Monsoons, Hurricanes, Cyclones.

The year 1983 was a year of extremes - severe drought, heavy rains, extreme heat, unseasonable cold, the culmination of the El Nino event. Specific events cited in this review include the record floods in the California, Utah and Colorado areas, torrential rains in Ecuador, ferocious storms in winter and spring which swept eastward across the North Atlantic into northern Europe and Scandinavia, drought in southern Africa, fires brought on by extreme heat and drought in Australia, heavy rains later causing floods in the same areas, rivers flooding in South America, drought and heat in the United States and Europe, below normal rainfall in western and central Africa, monsoons in southeast Asia, heavy rains in Mexico and southern United States, hurricanes and cyclones, and record cold in November in the United States. (Baker-IVI)
W86-01427

UNEVEN PATTERN; THE 1982-83 SNOW SEASON,
D. M. Ludlum.
Weatherwise, Vol. 37, No. 1, p 20-23, February, 1984. 3 Fig.

Descriptors: *Weather, *United States, *Snow, Snow cover, Snow pack.

In the United States the snow season of 1982-83 was characterized by its uneveness. The most unusual early-season snowstorms occurred in central Wyoming where Lander measured a total of 32.9 inches, a new September record. The big snow scene in October shifted to the Black Hills of South Dakota. The heavy snow season got underway in November in the Sierra of California with 105 inches at Twin Lakes. El Paso recorded the most unusual December snows, with a total of 18.2 inches. Precipitation in New England was deficient, and January showed record warming trends in all the snow country. March of 1983 brought the biggest snows of the year to California and the season continued at a good rate into April. Very heavy wet snows fell at higher elevations of the West topped by a storm which left an estimated four feet in the Bearpaw Mountains of north central Montana. Winter totals for the Pacif
tains included 707 inches at Twin Lakes
nia, and 667 inches at Rainier Paradise,
ton. At Donner summit in the central S
season total exceeded all others in a reco
back to 1870. The snowpack disappeared
Lake on July 22 after 270 days with 1 inch
on the ground and at Rainier Paradise o
after 280 days with snow cover. (Baker-IV
W86-01428

YEAR OF THE AFRICAN DROUGHT,
National Environmental Satellite, Data, a
mation Service, Washington, DC. Climat
ment Branch.
D. LeComte.
Weatherwise, Vol. 38, No. 1, p 8-15,
1985. 12 Fig.

Descriptors: *Climatology, *Africa,
*Drought, *United States, *Madagascar
pines, *Korea, *Canada, *USSR, Cyclon
ing, Weather data collections, Weather

Although drought in Africa has not bee
in recent years, during 1984 it covered a
dinary area. Early in the year hot, dry w
crop production by one-half across the
part of the continent. Later, during the
Hemisphere) spring, one of the worst dr
the century damaged food crops in Ea
Finally, major drought during the summe
Sahel zone agriculture, in west and centr
By the end of the year, the occurence o
with other factors such as civil war an
food stocks had produced famine in at l
African countries and resulted in food sh
nearly two dozen more. Highlights o
extremes in other areas in 1984 inclu
waves and storms early in the year in E
the United States, tropical cyclones hitti
gascar, the Philippines, and the east co
United States, floods in Korea, and d
Canada and the USSR. (Collier-IVI)
W86-01429

**HEAVY IN THE WEST, LIGHT IN TH
SNOWFALL IN 1983-84,**
D. M. Ludlum.
Weatherwise, Vol. 38, No. 1, p 26-30,
1985. 7 Fig.

Descriptors: *Weather patterns, *Snow
States, Air temperature, Precipitatio
cover.

Very little snowfall was recorded durin
month of the 1983 snow season, Septem
October, being a very warm month,
insignificant snowfalls. A crippling sto
from the central Rockies to the west
Lakes on Thanksgiving weekend and a
England experienced a white Christm
moderate storm on the 22-23 of Decem
first months of 1984 were very dry
country with snowfall far below norm
areas of the country experienced un
warm temperatures in February bu
brought the greatest snow of the seaso
England. Excessive amounts of snow als
area across southern Montana and north
ming and spread eastward into the D
April 25 to 28. In May only the western
witnessed any sizeable snowfalls. In Jun
snow cover at Berthoud Pass in Colorad
from 53 inches to bare ground by July
IVI)
W86-01430

**RECURRENCE INTERVAL OF D
EVENTS THROUGH STOCHASTIC A
OF RAINFALL AND STREAMFLOW**
Melbourne Univ., Parkville (Australia).
Civil Engineering.
For primary bibliographic entry see Field
W86-01444

NERALISED TECHNIQUE FOR THE ESTI-
TION OF PROBABLE MAXIMUM PRE-
ITATION IN INDIA,
eau of Meteorology, Melbourne (Australia).
Rakhecha, and M. R. Kennedy.
nal of Hydrology, Vol. 78, No. 3/4, p 345-359,
1985. 10 Fig, 22 Ref.

riptors: *Probable maximum precipitation,
mation, Design floods, Rainfall, Rainstorms,
graphy, Dew point, Mountains, Catchment

rsion of a generalized method of estimating
ble maximum precipitation (PMP) is applied
catchments of four large dams in India. The
of a secure dam is high both in terms of
n life and in economic terms. Reliable esti-
of PMP are required in estimating the design
for spillways of large earth and rockfill dams.
ates of PMP obtained using the traditional
d of moisture maximization and storm trans-
on can be unreliable as highly efficient rain
may not be represented in the rainfall
ls of an area. Generalized methods of (calcu-
PMP are used to obtain reliable estimates of
and also to give estimates which are consist-
er a region. This is done by pooling together
rainfall data from a very large area. The
depths are normalized for such factors as
dew-point temperature, distance of the storm
he coast, topographic effects and any inter-
mountain barriers between the rainfall area
e moisture source. These normalized values
en be applied to any individual catchment,
ie appropriate adjustment factors. (Author's
t)
1479

HERN OSCILLATION AND RAINFALL
ERNS IN THE SOUTHERN HEMI-
RE,
onwealth Scientific and Industrial Research
zation, Canberra (Australia). Div. of Forest
h.
ines, and A. I. Tomlinson.
African Journal of Science, Vol. 81, No. 3, p
March, 1985. 8 Fig, 36 Ref.

tors: *Rainfall, *Southern Oscillation,
rn Hemisphere, Rainfall distribution, Pre-
n, Climatology, Sea surface temperatures,

x of the Southern Oscillation was exam-
order to determine whether there were any
ons between the Southern Oscillation and
variations occurring in the southern hemi-
particularly in the south Pacific region.
ie results for the separate seasonal indices
mpared, an interesting and striking obser-
as that there were only minor differences
the curves obtained in all four cases. Such
vation implies strong persistence of the
Oscillation from month to month. The
indings appear to substantiate commonly
s of a link between the behavior of the
Oscillation and rainfall variations in the
hemisphere. Any such link no doubt de-
changes in atmospheric circulation and
onnections between the Southern oscilla-
fluctuations in sea-surface temperatures in
ic Ocean. On this basis, the out of phase
ip seen between the 6-7 year rainfall
South America and elsewhere in the
hemisphere from South Africa to Austra-
es understandable. This particular pheno-
robably explainable in terms of El Nino
d the time lags involved in the movement
ts across the Pacific Ocean. (Baker-IVI)
7

L VARIABILITY OF PRECIPITATION
NORTHEASTERN UNITED STATES,
v. of New York at Albany. Dept. of
ric Science.
din, and L. F. Bosart.
Weather Review, Vol. 113, No. 6, p 989-
, 1985. 28 Fig, 1 Tab, 19 Ref, 1 Append.

s: *Diurnal variation, *Precipitation,
patterns, Probability, Seasonal variation,
Rainfall distribution, New England, New York, New Jersey, Pennsylvania.

The diurnal and semidiurnal variations of precipitation over the northeastern United States (New England, New York, New Jersey and Pennsylvania) are investigated using 25 years of hourly precipitation data for 271 stations. The hourly data were harmonically analyzed for all measurable precipitation events ranging upwards to amounts < 10.0 mm. Additionally, a regional probability of precipitation analysis was performed for homogeneously grouped stations. The winter season (November-March) displays a general early-to-mid-morning diurnal maximum for all measurable precipitation events across the Northeast with a shift to just before noon southward into Pennsylvania. For heavier precipitation events, much of the region retains the morning maximum, a notable exception being the northern mountains of New York and New England, where there is a late-evening maximum. The spring (April-May) season is quite similar to winter, although the diurnal amplitudes become weaker everywhere except from southeastern Pennsylvania, up across the New York City metropolitan area, and into southern New England, where a stronger early-morning maximum appears. Evidence for nocturnal activity is seen across western New York and Pennsylvania in the heavier precipitation category, possibly in association with stagnating warm fronts that seldom move eastward due to cold air damming in New England. Summer (June-August) features a prominent diurnal cycle at most inland locations for all precipitation categories. A strong 1800 LST maximum exists in western Pennsylvania, with a trend towards a later maximum as one moves eastward towards southern New England. Coastal stations and those along the shores of Lakes Erie and Ontario show a tendency towards nocturnal precipitation, as there appears to be a suppression of daytime convection due to the cooler ocean and lake waters. The autumn (September-October) season displays a return to a weaker diurnal pattern, similar to spring. The morning maxima return to most places, except in the mountainous areas, where late season convection tends to peak in the afternoon. The semidiurnal cycle is weak across all seasons and tends to reflect the influence of local circulations. The regional probability of precipitation analysis reveals that much of the interior northeastern United States, with the exception of western and central Pennsylvania, has maxima centered at 0300, 1000 and 1800 LST for all measurable precipitation events during the cool season. These maxima appear to be the result of a blend of synoptic scale and mesoscale forcing involving phenomena peculiar to the local geography. During the spring and summer the afternoon convective signal is most strongly evident inland. It is especially pronounced in western Pennsylvania where a further nocturnal springtime maximum is seen. Finally, an analysis of precipitation by day of the week and by day of the lunar synodic cycle is presented. No concrete evidence is found to support either signal. (Author's abstract)
W86-01525

ROLE OF LIQUID WATER ON AN ICE SURFACE DURING RIMING ELECTRIFICATION - BASIC EXPERIMENT IN THUNDERSTORM ELECTRIFICATION,
Hawaii Univ. at Hilo. Cloud Physics Observatory.
For primary bibliographic entry see Field 2C.
W86-01528

EFFECTS OF DROP SIZE DISTRIBUTION TRUNCATION ON RAINFALL INTEGRAL PARAMETERS AND EMPIRICAL RELATIONS,
Clemson Univ., SC. Dept. of Physics and Astronomy.
C. W. Ulbrich.
Journal of Climate and Applied Meteorology, Vol. 24, No. 6, p 580-590, June, 1985. 9 Fig, 20 Ref. National Science Foundation grant ATM-8120686.

Descriptors: *Rain, *Drop size distribution, *Fluid drops, Statistical analysis, Disdrometers, Numerical analysis.

A description is given of a method of estimating the effects of truncating the raindrop size distribution (DSD) at lower and upper drop diameters D min and D max which assumes that the DSD can be approximated by a gamma distribution (including the exponential distribution). The method is used to investigate the effects of DSD truncation on rainfall integral parameters (e.g., reflectivity factor, liquid water content, etc.) and on empirical relations between pairs of these integral parameters. Tests of the theoretical predictions are performed using a set of drop size data collected with a Joss disdrometer. A brief description is also given of the use of the method to determine DSD truncation effects on precipitation parameters deduced from dual-measurement techniques. (Author's abstract)
W86-01534

FRACTAL PROPERTIES OF RAIN, AND A FRACTAL MODEL,
Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
S. Lovejoy, and B. B. Mandelbrot.
Tellus, Vol. 37A, No. 3, p 209-232, May, 1985. 18 Fig, 1 Tab, 36 Ref.

Descriptors: *Fractals, *Rainfall, *Model studies, Simulation, Probability, Statistical studies, Spatial distribution, Temporal distribution, Rainfall distribution.

This paper amplifies upon earlier theories and observations by the authors, advances a probabilistic model of rain fields, and exhibits realistic simulations. The model is also compared with other approaches. The theory of fractals has been in part motivated by the Hurst effect, which is an empirical observation in hydrology and climatology. A fractal is an unsmooth shape that is scaling, that is, where shape appears unchanged when examined by varying magnifications. The study of fractals is characterized by the prevalence of hyperbolically distributed random variables, for which $Pr(U > u)$ varies directly as u to the -alpha where Pr is the probability that the value of the variable exceeds u, and alpha is a positive exponent. Lovejoy established the applicability of fractals in meteorology, by showing that cloud and rain areas project on the Earth along shapes whose boundaries are fractal curves, and that the temporal and spatial structure of rain is rife with hyperbolically distributed features. These observations, as amplified in this paper, set up the challenge of constructing fractal models with the observed properties. The models presented here belong to a very versatile family of random processes devised in Mandelbrot: fractal sums of (simple) pulses, or FSP processes. The simulations to be presented reveal that these processes involve a scaling heirarchy of 'bands', 'fronts', and 'clusters', as well as other complex shapes, none of which had been deliberately incorporated in the process. This very rich morphology and the related statistical distributions exemplify the power of simple fractal models to generate complex structures, and are in accord with the wide diversity of actual rainfall shapes. It is argued that this model already provides a useful context in which the basic statistical properties of the rainfield, including the relationship between the temporal and spatial structure, may be studied. (Author's abstract)
W86-01749

SENSITIVITY OF AN ENERGY BALANCE CLIMATE MODEL WITH PREDICTED SNOWFALL RATES,
National Oceanic and Atmospheric Administration, Princeton, NJ. Geophysical Fluid Dynamics Lab.
K. P. Bowman.
Tellus, Vol. 37A, No. 3, p 233-248, 1985. 10 Fig, 2 Tab, 28 Ref, 1 Append. NSF grant ATM 8106800.

Descriptors: *Climate, *Energy balance, *Model studies, *Snowfall, Snow cover, Ice sheets, Solar radiation, Hydrologic cycle, Temperature, Water vapor, Atmospheric transport.

A two-level zonally-averaged seasonal energy balance model with separate land and ocean temperatures and an explicit surface energy budget is used

to study the effects of the snowfall rate of the extent of snow cover and ice sheets. Sensitivity experiments are performed both with and without ice sheets and with two different snowfall parameterizations. When snowfall rates are prescribed independent of latitude, higher snowfall rates increase the area of snow cover but reduce the sensitivity of the snow line to changes of the solar constant. To eliminate arbitrary assumptions about the snowfall rate, a relationship between the atmospheric transports of water vapor and sensible heat is derived and tested against observations. The relationship obtained is used to predict the meridional transport of water vapor in the model, from which the precipitation and snowfall are calculated. The response of the hydrologic cycle to changes of the solar constant is qualitatively similar to that found in general circulation models. The snow line is more sensitive with the predicted precipitation than with the prescribed precipitation because the predicted precipitation rate increases toward the equator. When ice sheets are included, they are larger than permanent snow cover under the same conditions because the cold surface temperatures at high elevations on the ice sheet inhibit melting. Feedback effects of the ice sheets are small, in part because they are limited to 30% of a latitude circle in this model. (Author's abstract)
W86-01750

GLOBAL STATUS AND TREND OF DESERTIFICATION,
United Nations Environment Programme, Nairobi (Kenya). Desertification Branch.
G. Karrar, and D. Stiles.
Journal of Arid Environments, Vol. 7, No. 4, p 309-312, 1984. 2 Fig.

Descriptors: *Desertification, *Drought, *International commissions, United Nations, Foreign aid, Erosion, Land use, Planning, Rainfall, Irrigation, Developing countries, Political aspects, Organizations.

Drylands are presently under stress to a degree perhaps unprecedented in history. High human and livestock populations growth, chronic drought and bad land-use practices in many areas have resulted in 75% of all the productive land within the world's drylands becoming desertified to some extent. A United Nations Conference on Desertification in 1977 formulated the Plan of Action to Combat Desertification (PACD). On all fronts, desertification has worsened since the conference. Land irretrievably lost to desert continues at 60,000 sq km/yr, while land rendered economically unproductive is showing an increase at 210,000 sq km/yr. Most responsibility for implementing the PACD at the national level rests with governments. UNEP (United National Environment Program) hoped to use the occasion of the 12th Governing Council and the presentation of the Executive Director's report on the General Assessment to stimulate renewed interest in the global problem of desertification. It is a problem which needs immediate, concentrated attention by the world's governments and international organizations. (Baker-IVI)
W86-01855

INCIDENCE OF DROUGHTS AND ITS IMPACT ON FOOD PRODUCTION IN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
G. G. S. N. Rao, Y. S. Rama Krishna, B. V. Ramana Rao, and R. S. Purohit.
Annals of the Arid Zone, Vol. 23, No. 4, p 327-334, 1984. 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Drought, *Crop yield, *Rajasthan, *India, Monsoons, Millet, Pulses, Rainfall, Aridity index.

Failure of the monsoon rains leading to drought conditions is common in Rajasthan State, India. The incidence and spread of drought over Rajasthan during the years 1972, 1974 and 1979, were analyzed on the basis of departures from the normal aridity index during different months of the southwest monsoon season. District averages of monthly rainfall for all the 26 districts in Rajasthan State were obtained from the daily rainfall records. The average rainfall in the State decreased by 32, 18 and 7% during the drought years 1972, 1974 and 1979, respectively. Consequently 84, 68 and 86% of the total area was affected by drought in the respective years. Productivity of pearlmillet and pulses was considerably affected by drought conditions. The impact of drought on the fall in productivity of these crops is more pronounced in western Rajasthan than in eastern Rajasthan. The decrease in yields during the three drought years varied from 61 to 92% in pearlmilet and 71 to 86% in the pulse crop. The variations in the productivity of the rainfed crops can be explained satisfactorily by the pattern of incidence and the spread of droughts. (Moore-IVI)
W86-01856

2C. Snow, Ice, and Frost

MODELLING ALPINE SNOW ACCUMULATION AND ABLATION USING DAILY CLIMATE OBSERVATIONS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Geography.
R. D. Moore, and I. F. Owens.
Journal of Hydrology (New Zealand), Vol. 23, No. 2, p 73-83, 1984. 5 Fig, 2 Tab, 20 Ref.

Descriptors: *New Zealand, *Model studies, *Snow, *Ablation, Alpine regions, Air temperature, Mountains, Simulation, Precipitation, Altitude.

Modelled snow storage is compared to data from a snow course in the Craigieburn Range, and the utility and limitations of this approach are assessed for New Zealand conditions and data availability. Low-altitude precipitation measurements appear to provide a good index of high-altitude precipitation when averaged over the accumulation season. Snow storage was reasonably reproduced when temperatures measured at a site above the seasonal snow-line were used. The simulation quality was less satisfactory when low-altitude temperatures were used, because of marked and systematic deviations of the actual from the assumed lapse rate, and the consequent problem of distinguishing rain from snow. If no high altitude temperature measurements are available, the use of observations of storm snow-line elevations to determine the phase of precipitation may improve simulation quality. Application of these approaches should help to overcome lack of data on snow accumulation in mountainous areas of New Zealand. (Baker-IVI)
W86-01385

UNEVEN PATTERN; THE 1982-83 SNOW SEASON,
For primary bibliographic entry see Field 2B.
W86-01428

INTERNATIONAL PERSPECTIVE ON LARGE-SCALE SNOW STUDIES,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
A. Rango.
Hydrological Sciences Journal, Vol. 30, No. 2, p 225-238, June, 1985. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *International commissions, *Snow, *Large scale studies, *Research priorities, Precipitation, Remote sensing, Policy making, Governmental interrelations, Political aspects.

Because of significant physical differences between snow and other naturally occurring substances, snow is not only a valuable resource but it also has significant large-scale effects on weather, climate and the hydrological cycle. A working group of the IAHS International Comission on Snow and Ice (ICSI) has recently reached certain conclusions regarding these effects. In order to study and model the large-scale effects of snow, the standardization of existing ground observation methods, the exploitation of new technologies such as remote sensing, and the systematic archiving of all data are necessary. Various research efforts and international activities have been identified which, when accomplished, should lead to improved unde ing and management of the large-scale ef seasonal snow cover. An international orga should take the lead in promoting an exch ideas, techniques, measurements, research and management strategies on large-scal studies. (Author's abstract)
W86-01446

ROLE OF LIQUID WATER ON AN IC FACE DURING RIMING ELECTRIFICA BASIC EXPERIMENT IN THUNDERS ELECTRIFICATION,
Hawaii Univ. at Hilo. Cloud Physics Obse
T. Takahashi.
Journal of the Meteorological Society o Vol. 63, No. 2, p 262-266, April, 1985. 3 Ref.

Descriptors: *Electrification, *Ice, *Rim perature effects, Clouds, Thunderclouds, E properties, Hail, Snow, Thunderstorms.

Since the surface potential of liquid water c surface is negative, the negative space cha be enriched in the liquid layer. When this charge liquid layer is torn off as ice crystal and separate, a positive charge will be mea rime. The present study examines this phen in the cold room. At warm temperature regions where the cloud water content high, graupel (or hail) may be electrified p if the water film on the ice surface is rem ice crystals when they collide and separat contact area is 10 micro-m x 100 micr separated charge during such a process w the order of 10 to the minus 5 power esu, similar to the order of magnitude observe riming. At colder temperatures, except in where the water content is very high, char ration will be associated with the defect form during ice fracture if this occurs in a growth stage. Under hail growth condi colder temperatures, hail may be electrifie either dropsplashing or ice crystal contac tion while liquid water flows over the hail The chemical impurities of water will d the polarity of the charge which is separ the latter case, the detachment of water ma necessary for charge separation. (Baker-IV W86-01528

SENSITIVITY OF AN ENERGY BALAN MATE MODEL WITH PREDICTED FALL RATES,
National Oceanic and Atmospheric Ad tion, Princeton, NJ. Geophysical Fluid D Lab.
For primary bibliographic entry see Field 2
W86-01750

ICE STORM DAMAGE TO A SOUTHE CONSIN MESIC FOREST,
Wisconsin Univ.-Milwaukee. Dept. of B Sciences.
L. P. Bruederle, and F. W. Stearns.
Bulletin of the Torrey Botanical Club, V No. 2, p 167-175, April-June, 1985. 1 Fig, 4 Ref.

Descriptors: *Ice storms, *Storm damag ests, *Wisconsin, Litter, Canopy, Wind, T phy, Climate, Slope, Glaze, Elm trees, I trees.

In 1976, an extensive ice storm struck Wisconsin, resulting in substantial damag upland forest at the University of Wisco waukee Cedar-Sauk Field Station. Stron easterly winds following the storm (80.6 k exacerbated the damage. A forest fuel technique was modified to measure the v macro-litter resulting from the ice sto canopy was photographed using both wi and fish-eye lenses to determine the effect overstory. Macro-litter volume was deter be 19.35 cu m/ha, accounting for a loss of mately 35% of the canopy. Damage wa and was influenced by topographic and

ors; inclination and aspect of slope, as well as
d were found to be of particular importance.
cies susceptibility to glaze varied considerably.
ceptibility was quantified by preparing a ratio
he observed macro-litter volume with the ex-
ed volume based upon the relative dominance
ach species in the stand. Ratio products ranged
1.55 for Ulmus rubra, the most susceptible
ies, to 0.17 for Ostrya virginiana. Factors re-
sible for species susceptibility include growth
, mechanical properties of wood, tree age and
ee of decay, and position in the canopy. (Au-
's abstract)
-01760

IPLING OF SNOW AND ICE ON LAKES,
t Univ., Peterborough (Ontario). Dept. of Ge-
phy.
. Adams, and N. T. Roulet.
ic, Vol. 37, No. 3, p 270-275, September, 1984.
, 3 Tab, 15 Ref.

riptors: *Ice, *Snow, *Lake ice, *Elizabeth
*Labrador, White ice, Black ice, Lakes,
cover, Seasonal variation.

e years of data were collected on the late
r snow and ice cover of Elizabeth Lake,
dor, with a view to developing practical and
ive sampling procedures for snow and ice on
in general. Elizabeth Lake has an area of
ha, a mean/maximum depth of 8.7 m/27.1 m
volume of 2.45 x 10 to the 6th power cu m.
ariation between years in mean cover values
ot large. Mean snow depth varied most be-
years, and total ice cover the least. Black ice
e water frozen in situ, while white ice is
d following the slushing of a snow cover. In
of distribution present on the lake at the time
surveys, white ice consistently had the high-
efficient of variation, with total ice again
the lowest. The pattern for black ice forms
resting reversal of the white ice pattern with
ice around the margins and downwind.
lustrated that these two types of ice tend to
pensatory. (Baker-IVI)
1788

Evaporation and Transpiration

OLOGY OF MID-ALTITUDE TUSSOCK
SLANDS, UPPER WAIPORI CATCH-
: II - WATER BALANCE, FLOW DURA-
AND STORM RUNOFF,
ealand Forest Service, Rotorua. Forest Re-
Inst.
mary bibliographic entry see Field 2A.
384

RENTIAL EVAPO-TRANSPIRATION
A CLAY SURFACE AND ITS INFLU-
ON EQUILIBRIUM POREWATER
URE,
Associates, Maidenhead (England).
mary bibliographic entry see Field 2G.
451

ATION OF EVAPORATION FROM THE
ALLY 'DRY' LAKE FROME IN SOUTH
ALIA,
nwealth Scientific and Industrial Research
ation, Glen Osmond (Australia). Div. of

lison, and C. J. Barnes.
of Hydrology, Vol. 78, No. 3/4, p 229-242,
85. 5 Fig, 3 Tab, 15 Ref.

ors: *Lake Frome, *South Australia, *Dry
Evaporation, Groundwater inflow, Saline
euterium, Recharge.

ome, situated in northern South Australia,
water only rarely, the last time being in
d 1973-74. Depth profiles of deuterium
ion, expressed as delta-values, have been
make point estimates of evaporation from
of the normally 'dry' Lake Frome. Values
e sites, varying between 90 and 230 mm/yr, have been used to obtain a relatively crude approximation for mean evaporation rate from the lake of 170 mm/yr. This estimate is lower than would be expected at first sight for an almost saturated sediment surface with a water table at about 300 mm in an environment where the evaporation rate from a Class A pan is 3200 mm/yr. Actual evaporation is reduced well below potential because the vapor pressure deficit between the atmosphere and water at the evaporating surface is reduced because this water is saturated with sodium chloride. Because the surface is almost white, it has an albedo much higher than that of a free-water surface. The total evaporative flux from the lake is estimated to be 4.6 x 10 to the 8th power cu m/yr. In periods of no surface water inflow to the lake this represents the groundwater inflow to the lake. Under steady state conditions, and assuming that the surface catchment and the groundwater catchment are identical, this corresponds to a mean recharge flux of about 1 mm/yr over the catchment. (Moore-IVI)
W86-01471

DIFFERENCES IN ANNUAL EVAPORATION BETWEEN GRAZED PASTURE AND EUCALYPTUS SPECIES IN PLANTATIONS ON A SALINE FARM CATCHMENT,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
E. A. N. Greenwood, L. Klein, J. D. Beresford, and G. D. Watson.
Journal of Hydrology, Vol. 78, No. 3/4, p 261-278, June, 1985. 8 Fig, 4 Tab, 5 Ref.

Descriptors: *Evaporation, *Eucalyptus trees, *Pastures, *Australia, Saline seeps, Leaf area, Interception, Stem flow, Land reclamation, Saline farm land.

Daily evaporation (including evaporation from the ground surface) from grazed annual pastures and from five species of Eucalyptus in two farm plantations (in Australia) was measured at regular intervals for a year. Leaf area of trees and pasture, and rainfall interception and stem flow by trees, were also measured. The trees were in their seventh year after germination. The site was a first-order catchment that had developed a saline seep midslope after the felling of the prior forest. One plantation was upslope, the other was immediately above the seep. The work is part of a salinity reclamation study based on increased evaporation through the strategic use of trees. Annual evaporation from pastures was 390 mm regardless of position in the landscape. Annual evaporation from trees upslope was 2300 mm for Eucalyptus maculata and 2700 mm each for E. globulus and E. cladocalyx. Values at midslope were 1600 mm for E. wandoo, 1800 mm for E. leucoxylon and 2200 mm for E. globulus. Expressed as a proportion of annual rainfall (680 mm), annual evaporation was 0.6 for pasture and ranged from 2.4 to 4.0 for trees while interception by trees ranged from 0.16 to 0.36, and stem flow was less than 0.02. Annual evaporation, but not interception, was correlated with leaf area. The application of these findings is discussed. It is concluded that the planting of discrete areas of trees has the evaporation potential to assist in reclamation of saline farm land in the southwest region of Australia and that some species are much more effective than others. (Author's abstract)
W86-01473

SIMPLIFIED PROCEDURE FOR THE EVALUATION OF THE LAKE KINNERET EVAPORATION,
TAHAL-Water Planning for Israel Ltd., Tel-Aviv.
E. Simon, and F. Mero.
Journal of Hydrology, Vol. 78, No. 3/4, p 291-304, June, 1985. 4 Fig, 4 Tab, 10 Ref.

Descriptors: *Lake evaporation, *Lake Kinneret, *Israel, Hydrologic budget, Energy balance, Mass transfer, Meteorology, Air temperature, Water temperature, Evaporation.

Actual evaporation losses from lake surfaces can still not be determined by direct measurements. This presents a major problem to the planners, especially in cases as Lake Kinneret (Israel), where evaporation losses represent about 30% of its water budget. A description is given of the various approaches to find an optimal method for the quantitative estimation of evaporation losses from this lake, to enable reliable water-budget calculations and also to serve as a tool for the various water allocation models for long-range planning, now under development. Past experience shows that the best evaporation estimates can be obtained by the energy balance and the mass transfer methods, widely used all over the world. In this case, two micro-meteorological stations were installed on the up-wind western and the down-wind eastern shore of the lake. The big mass of the accumulated data has been carefully analyzed, and served as a basis for the various theoretical and more or less empirical approaches to obtain the desired optimal estimate of lake evaporation losses. Another problem to be solved was to find simpler, more easily obtainable data (as air and water temperatures, etc.), to serve as long-term evaporation estimator, to permit reconstruction of long-term series of Lake Kinneret water balances, to permit optimized use of the available water resources originating from the Jordan River and the direct drainage area of this lake. The various estimation methods, discussed in this paper were calibrated and compared to the now used energy balance method, considered as the most reliable approach for the evaporation measurements. During the process of these analyses, some doubts were raised as to the reliability of frequently used methods for the elusive estimate of evaporation losses. (Author's abstract)
W86-01475

CALCULATING THORNTHWAITE AND MATHER'S ACTUAL EVAPOTRANSPIRATION USING AN APPROXIMATING FUNCTION,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. Pastor, and W. M. Post.
Canadian Journal of Forest Research, Vol. 14, p 466-467, 1984. 1 Fig, 6 Ref. DOE contract W-7405-eng-26.

Descriptors: *Evapotranspiration, *Water loss, *Soil water, Precipitation, Temperature effects, Water storage.

Soil water storage is related to a maximum storage value (field capacity) and accumulated potential water loss through a simple negative exponential function. This formula summarizes 10 tables from the Thornthwaits and Mather (Publications in Climatology, 10: 183-311, 1957) needed to calculate actual evapotranspiration. Values predicted by this formula and the Thornthwaite and Mather's tabulated values are compared. Discrepancies between tabulated and predicted values occurred largely due to the fact that the equation is a continuous function while the tables are step functions. (Baker-IVI)
W86-01780

2E. Streamflow and Runoff

SOUTHLAND FLOOD OF JANUARY 1984,
Southland Catchment Board, Invercargill (New Zealand).
D. C. Riddell.
Journal of Hydrology (New Zealand), Vol. 23, No. 2, p 120-129, 1984. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Rainfall, *Southland, *New Zealand, *Waihopai River, *Floods, Storm runoff, Water levels, Probable maximum precipitation, Flood hydrographs, Flood flow.

Nine automatic raingauges and more than 100 manual gauges gave an excellent record of the storm rainfall which caused the floods of January 1984 in Southland and caused extensive damage. River flows and lake levels were recorded at 17 sites. Over the 18 hours which the storm lasted, heavy rainfall was associated with fronts in an extremely deep and humid northwesterly airflow. The estimated probably maximum flood for the

Waihopai River which flows through Invercargill is twice the size of the January 1984 flood which reached 112 times mean flow. Being far larger than any other storm experienced in recent times, the 1984 storm provided an opportunity for assessing the likely probable maximum precipitation for the Invercargill region and particularly for the Waihopai River catchment. Temporal distribution of the January 1984 storm rainfall was similar to that normally assumed for the probable maximum precipitation, so a probable maximum flood hydrograph for the Waihopai River was derived by scaling the ordinates of the January flood hydrograph by the ratio of the probable maximum direct runoff to the January runoff. If 10% of the probable maximum precipitation were retained in storage, a direct runoff of 21 mm would be expected. This is twice the January 1984 flood runoff. With baseflow this would result in a probable maximum peak flow of 580 cu m/sin the Waihopai River, a specific discharge of 3.6 cumecs per square kilometer. (Baker-IVI)
W86-01388

DRAINAGE COEFFICIENTS FOR HEAVY LAND,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W86-01431

PROBABILITY-DISTRIBUTED PRINCIPLE AND RUNOFF PRODUCTION AT POINT AND BASIN SCALES,
Institute of Hydrology, Wallingford (England).
R. J. Moore.
Hydrological Sciences Journal, Vol. 30, No. 2, p 273-297, June, 1985. 10 Fig, 33 Ref.

Descriptors: *Statistical analysis, *Runoff forecasting, *Hydrologic models, *Rainfall-runoff models, Infiltration capacity, Storage capacity, Overland flow.

The probability-distributed principle in basin-scale hydrology considers the frequency of occurrence of hydrological variables (model inputs, parameters or elements) of certain magnitudes over the basin without regard to the location of a particular occurrence within the basin. The random assemblage of different parts is considered more important than the relation of the parts, one to another. Rainfall-runoff models based on probability-distributed infiltration capacity and storage capacity concepts, and which generate runoff according to Hortonian and saturation overland flow mechanisms respectively, are distinguished. Two types of probability-distributed storage capacity model are identified, one based on an assumption that storage elements at points in the basin respond independently of their neighbors, and the other where storage elements interact so as to equalize the depth of stored water over the basin. Allowing redistribution of water leads to simplification of the model equations. The probability-distributed principle is also used to represent the process of water translation through the basin. Interpretation of the instantaneous unit hydrograph as a probability density function of translation time is demonstrated and the inverse Gaussian density proposed as a suitable functional form on physical grounds. (Author's abstract)
W86-01449

RIVER RECESSION ANALYSIS IN THE OPERATIONAL MANAGEMENT OF LAKE ABSTRACTION,
S. Walker, and D. Pearson.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 3, p 244-253, June, 1985. 7 Fig, 4 Ref.

Descriptors: *Water level fluctuations, *Lakes, *Water management, Mathematical equations, Water level, Forecasting, Stream flow, Rivers.

The need to obtain reliable estimates of the likely changes in stream flow with time has led to a reappraisal of the methods available for analyzing flow data. The need also to include a stochastic component in the description of the way in which such data arise leads to some problems, but the developed techniques have been found to provide a reasonable solution to them. The methods are attractive, as they make no assumptions about the relationship between successive daily flows and hence may be applied in a wide range of situations. Some care is required when analyzing data with a high level of observational noise and for which recession rate varies markedly with flow. The search for more flexible techniques was justified by the analysis of flow data from Windermere and Ullswater. Here, recession rate varied with flow, and the relationship between them was different with and without abstractions. Changes in recession rate with flow were also observed on the river Derwent, though these were of a smaller order than those observed on the rivers controlled by lakes. A comparison between the recession curve for the unregulated flow in the river Derwent and the curves for Windermere and Ullswater in the no-pumping case is presented. The curves for Ullswater and the Derwent are similar, showing a steady quickening of recession rate as flow increases. This is the shape which can be expected for an uncontrolled river. In comparison, the curve for Windermere is much flatter. This is reasonably explained by difference in physical characteristics of the outlets to the lakes. The recession curves for Windermere have been used to construct a diagram showing the number of days for which pumping is likely to be sustained before the flow falls below a prescribed flow level. This is now being used as an aid in the everyday operation of the pumping station, and proves a practical example of the value of obtaining reliable estimates of recession factors for use in the management of lake and river abstraction systems. (Baker-IVI)
W86-01522

TURBULENT FLOWS OVER A WAVY BED,
Delaware Univ., Newark. Ocean Engineering Program.
N. Kobayashi, and O. S. Madsen.
Journal of Geophysical Research, Vol. 90, No. C4, p 7323-7331, July, 1985. 3 Fig, 1 Tab, 24 Ref.

Descriptors: *Turbulent flow, *Wavy beds, *Hydrodynamic models, Model studies, Shear stress, Boundary conditions, Ripples, Hydraulics, Hydrodynamics, Fluid mechanics.

A hydrodynamic model was developed for the calculation of shear stress and pressure along a sinusoidal boundary that is fixed or propagating very slowly in a wide rectangular open or closed channel. The model uses curvilinear coordinates that follow the wavy boundary, and it is similar to that for two-dimensional wavy boundary flows of infinite extent proposed by Benjamin except that the present model takes account of turbulent stresses on the basis of the turbulent eddy viscosity concept employed by Hussain and Reynolds. The compact analytical expressions for the perturbed shear stress and pressure on the wavy boundary are derived for the cases of hydraulically smooth turbulent and fully rough turbulent flows. The developed model is shown to be in good agreement with the experiments conducted by Zilker et al. The developed hydrodynamic model is applied to the problem of the formation of ripples in erodible channels by Kobayashi and Madsen. (Author's abstract)
W86-01537

TRAPEZOIDAL CHANNELS WITH INCREASING DISCHARGE,
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Ingenieria.
R. Guarga, and M. Lara.
Journal of Engineering Mechanics, Vol. 110, No. 7, p 1050-1059, July, 1984. 4 Fig, 3 Tab, 16 Ref.

Descriptors: *Trapezoidal channels, *Channel flow, *Stream discharge, Hydraulics, Cross-sections, Numerical analysis, Mathematical equations.

Flow in channels of trapezoidal section has not been treated in general, although it is the most frequent encountered in practice; there has also not been a complete review of the possible cases of flow in a channel of trapezoidal section
creasing flow. Previously, the solution to th
lem of increasing discharge in trapezoid
sectional channels has been obtained via nu
computation for each particular case. The
was studied using the classic equation of '
tum' which is normalized utilizing the coo
of the singular point. Using linear transfor
it is possible to reduce the classic equat
channels with increasing discharge to a u
equation for all the cases of trapezoidal sec
non-zero slope. The possible flow cases in
nel with increasing discharge arise from th
sis of this equation. In the case of a chan
zero slope, the exact solution to this pro
obtained by analytical integration of the
for the adimensional parameters. It was po
completely analyze different flow regim
may occur in the channel and also the
representing the free surface may be cl
(Collier-IVI)
W86-01541

STORMWATER RUNOFF FROM HIGH
Rhode Island Univ., Narragansett. G
School of Oceanography.
For primary bibliographic entry see Field 5
W86-01605

NUTRIENT RUNOFF LOSSES AS PRED BY ANNUAL AND MONTHLY SOIL PLING,
Agricultural Research Service, Duran
Water Quality and Watershed Research La
For primary bibliographic entry see Field 5
W86-01709

INFLOW SEEPAGE INFLUENCE STRAIGHT ALLUVIAL CHANNELS,
Colorado State Univ., Fort Collins. Dept.
Engineering.
J. R. Richardson, S. R. Abt, and E. V. Rich
Journal of Hydraulic Engineering, Vol. 11
p 1133-1147, August, 1985. 8 Fig, 3 Tab,

Descriptors: *Inflow seepage, *C
*Streambeds, Seepage, Hydraulics, Sedime
port, Scour, Fluid dynamics.

A flume study was conducted to identify
lyze the effects of inflow seepage on
straight alluvial open channels. The e
inflow seepage on energy slope, water
depth, velocity, sediment transport, scc
forms, and resistance to flow was investiga
results of this investigation indicated tha
seepage increases localized mean channel
energy slope, and stream power in the
inflow. The water surface depth decre
subcritical flow and remained nearly cons
supercritical flow during inflow condition
ment transport was slightly increased whe
was introduced in the bed. Inflow seepage
appear to enhance channel scour. Inflow
significantly enhanced bed form transfo
and the bed roughness. Inflow seepage als
dunes to become longer, flatter, and mo
erratically in the reach where inflow o
Inflow seepage could significantly influe
channel hydraulics, stream power, bed fo
bed roughness in the localized zone of
(Author's abstract)
W86-01731

DETERMINATION OF RIPPLE GEON
Queen's Univ., Kingston (Ontario). Dept.
Engineering.
M. S. Yalin.
Journal of Hydraulic Engineering, Vol. 11
p 1148-1155, August, 1985. 4 Fig, 10 Ref.

Descriptors: *Ripple geometry, *Ripple
*Streambeds, Sediment transport, Hy
Fluid mechanics.

Laboratory measurements were carried ou
mobile bed covered by ripples generate
open channel flow. The bed materials us

onless and reasonably uniform; the steady-ubcritical flume flow was in equilibrium and nearly two-dimensional. In addition to the itional runs conducted with water, special ere conducted with a water and glycerine e. Using the results of these measurements, as the data of other reliable sources, a series rimental curves were determined which can to predict the length and height of ripples. alysis of the data indicates that the dimen- quantities related to the geometry of rip- functions of two dimensionless variables. them must be a combination reflecting the of sediment-transporting flow, the other an arrangement of parameters characteriz- physical nature and the liquid and solid nvolved. (Author's abstract)
732

CTION OF 2-D BED TOPOGRAPHY IN
s,
opkundig Lab. te Delft (Netherlands).
nary bibliographic entry see Field 2J.
734

RISON OF THE RESULTS OF CALCU- UNSTEADY FLOW IN THE ENISEI STRETCH BY THE FINITE-DIFFER- ND FINITE-ELEMENT METHODS,
ya Nauk SSSR, Moscow. Inst. Vodnykh

ntorovich, and T. A. Lysenko.
esources, Vol. 11, No. 4, p 289-293, July-1984. 3 Fig, 2 Tab, 4 Ref. Translated from Resursy, No. 4, p 30-34, July-August,

ors: *Unsteady flow, *Finite element *Enisei River, *USSR, Flow, Hydraulics, Wind, Surges, Computers.

h stretch of the Enisei River (USSR) was ed between Selivanikha and Baikalovsk, length of about 800 km. The upriver on of a surge wave forming within the and Enisei Gulf was investigated in this he formation of the surge is due to the of aperiodic fluctuations of the water e mouth nearshore zone occurring under of wind and causing a variable backwa- ne initial information for assigning the and geometric characteristics of the f the Enisei mouth region in the calcula- data was used of hydrometric and mor- measures which were preliminarily cor- th consideration of an analysis of the a number of calculations of the propaga- ges in 1962, 1963, 1969, 1972, and 1973. n by the finite-difference method was on a BESM-6 computer according to a ritten in ALPHA-6. Although the com- translators used are different, an esti- e of the expenditures of computer time e conclusion that these expenditures are s for calculation by the finite-element he calculations of unsteady flow by nt equations showed that for such a object as the mouth stretch of the er the use of the finite-element method ne gain in accuracy and expenditures of me compared with the finite-difference aker-IVI)

TURE REGIME IN WATER BODIES OLGA DELTA UNDER REGULATED CONDITIONS,
Reserve (USSR).
kov, and A. V. Moskalenko.
ources, Vol. 11, No. 4, p 347-354, July-84. 4 Tab, 6 Ref. Translated from esursy, No. 4, p 95-99, July-August,

: *Water temperature, *Volga Delta, unoff, Temperature effects, Weather, rological regime, Swamps, Lakes.

perature is one of the important ele- e hydrologic regime which has a con-siderable effect on natural processes in water bodies of the Volga delta (USSR). The temperature regime of various water bodies of the delta is different and depends on the temperature of the water arriving there from the Volgograd reservoir, general weather conditions of the region, daily variation of the air temperature in the delta, depths of the water body, flowage, and its overgrowth by aquatic vegetation. In the shallow channels criss-crossing the delta the flowage is slightly weaker than in the Volga branches, the water temperature is higher than in the Volga but lower than in the backswamp and delta lakes. Heated water can flow into such shallow channels from the back swamps and delta lakes. The temperature regime of the backswamps and delta lakes in the lower part of the Volga-Aktuba floodplain differs somewhat from the temperature regime of the backswamps and lakes of the lower reaches of the delta. This is related to the fact that in the floodplain flooding of the backswamps and lakes occurs rapidly, primarily with cold surface waters of the Volga; the depths are considerably greater; flowage sets in at the start of their flooding; the current speeds are considerable; owing to the absence of dense aquatic and terrestrial vegetation heating of the water column in them occurs gradually and uniformly from the surface to the bottom. The rise of water temperature in water bodies of the delta after the ice period occurs at different times throughout its territory. As a result of regulating the Volga runoff, considerable changes occurred in the characteristics of the temperature regime of the delta water bodies. An increase of the water temperature in the delta water bodies in the fall-winter period already has an effect on the dynamics of the hydrologic and geomorphologic processes occurring in them. The current state of the thermal regime should be taken into account when planning and conducting measures to increase the biological productivity of the delta water bodies. (Baker-IVI)
W86-01809

FINITE AMPLITUDE WAVES IN STRATIFIED TWO-PHASE FLOW: TRANSITION TO SLUG FLOW,
California Univ., Santa Barbara.
R. Ahmed, and S. Banerjee.
AIChE Journal, Vol. 31, No. 9, p 1480-1487, September, 1985. 8 Fig, 13 Ref. NSF grant CP-81-12667.

Descriptors: *Slug flow, *Two-phase flow, *Mathematical equations, Density, Velocity, Waves, Schrodinger equation, Stratified flow, Wave amplitude.

In horizontal two-phase flow, phases stratify due to density differences if the velocity difference between the phases is small relative to the phase velocities. as the velocity difference between the phases is increases, waves appear on the initially smooth interface but the phases remain distinctly separated. At sufficiently high velocity differences interfacial waves grow rapidly, tending to block the flow, i.e., they are swept up to form slugs. A perturbation technique based on the method of multiple scales is used to solve the system of equations governing finite amplitude waves at the interface between two bounded fluids. This method allows the separation of the system into two parts: the rapidly varying phase of the disturbances, and the slowly varying amplitude. The complex system of equations governing the modulation of the wave amplitude can be reduced to a nonlinear Schrodinger equation. Nonlinear instability is essentially determined by the signs of two coefficients in the Schrodinger equations, leading to an analytically established criterion for the growth of finite-amplitude waves at the interface between two bounded flowing fluids. The predictions made by this study are in reasonable agreement with existing experimental results and appear to provide a theoretical framework for interpreting experiments on transition from stratified to slug flow. (Moore-IVI)
W86-01864

2F. Groundwater

EXPERIMENTAL MEASUREMENT OF CHANNELING OF FLOW IN POROUS MEDIA,
Cold Regions Research and Engineering Lab., Hanover, NH.
J. L. Oliphant, and A. R. Tice.
Soil Science, Vol. 139, No. 5, p 394-399, May, 1985. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Soil water, *Channeling, *Porous media, *Permeability coefficient, Unsaturated flow, Montmorillonite, Clays, Hydraulics, Silt.

By comparing experimental measurements of the hydraulic conductivity and the effective self-diffusivity of water in porous media, a channeling parameter, c, is defined. This parameter measures the degree of division of flow paths in the media, but does not depend on the tortuosity of the paths or surface effects on the viscosity of the water. Values of c are obtained for Na-saturated montmorillonites containing from 0.82 to 7.7 g of water per g of clay and for Fairbanks silt containing from 0.135 to 0.23 g of water per g of silt. Values for the montmorillonites remain relatively close to the theoretically predicted value of 1/3 of all water contents, indicating maximally divided flow paths. Values for the silt vary from 100 to over 2000, indicating highly channeled flow. (Author's abstract)
W86-01419

ELECTRICAL RESISTIVITY FOR ESTIMATING GROUND-WATER RECHARGE,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
W. E. Kelly.
Journal of Irrigation and Drainage Engineering, Vol. 11, No. 2, p 177-180, June, 1985. 2 Fig, 7 Ref. NSF grants GK-42130 and ENG 78-19408.

Descriptors: *Groundwater recharge, *Resistivity, *Unsaturated flow, Permeability coefficient, Vadose water, Hydrogeology.

Estimates of recharge rates from surface resistivity measurements should be possible under favorable conditions. Electrical properties of unsaturated soils can be characterized by a form of Archie's law. Differences in resistivity are primarily due to differences in degree of saturation with fine-grained sediments tending to occur in situ at lower resistivities than coarse sediments which occur at lower degress of saturation. On a relative basis, higher transverse resistances would reflect sites more favorable for recharge. Estimates of transverse resistance may be made without interpreting sounding curves in some cases. When sounding curves can be completely interpreted, the resistivity of the vadose zone can be estimated. The resistivity of this layer will be an average transverse resistivity which should correlate with the average hydraulic conductivity of the vadose zone during recharge. Field data under a variety of geohydrological conditions are needed, along with lab work on the electrical properties of unsaturated soils and a study of the geometric effects mentioned. This information would provide a sounder basis for applying the surface resistivity in recharge studies. (Baker-IVI)
W86-01437

THERMAL INFRARED DETECTION OF SUBMARINE SPRINGS ASSOCIATED WITH THE PLYMOUTH LIMESTONE,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
I. S. Roxburgh.
Hydrological Sciences Journal, Vol. 30, No. 2, p 185-196, June, 1985. 11 Fig, 1 Tab, 15 Ref.

Descriptors: *Infrared imagery, *Submarine springs, *Plymouth Limestone, *Devon, *England, Remote sensing, Springs, Groundwater, Limestone, Coastal aquifers, Geomorphology, Geohydrology.

The Plymouth Limestone is the most westerly of a number of separate carbonate outcrops occurring in South Devon, England. In the absence of land-based springs and in the presence of a groundwater gradient which falls seawards from the Upper Devonian slates to the limestone, it is possible that

groundwater discharge from the Plymouth Limestone is taking place through a number of coastal and submarine springs in Plymouth Sound. Freshwater groundwater within the Plymouth Limestone can be shown to be in hydraulic continuity with the marine waters of Plymouth Sound. Fresh groundwater discharges from the limestone in the form of submarine springs can be detected on the basis of temperature differences between the fresh groundwater and the marine waters using an aircraft-mounted thermal infrared linescanner. Analysis of the thermal data is improved and aided by the use of the GEMS color contouring analysis facility. (Collier-IVI)
W86-01443

APPROPRIATE MONITORING TECHNIQUES USING BOMB TRITIUM AND OTHER GEOCHEMICAL PARAMETERS IN HYDROGEOLOGICAL INVESTIGATIONS,
Anambra State Univ. of Technology, Awka (Nigeria). Water Resources and Environmental Pollution Unit.
B. C. E. Egboka.
Hydrological Sciences Journal, Vol. 30, No. 2, p 207-224, June, 1985. 7 Fig, 3 Tab, 40 Ref.

Descriptors: *Tritium, *Isotope studies, *Geochemistry, *Geohydrology, Water chemistry, Monitoring, Radioisotopes, Groundwater movement, Groundwater dating.

Since the atmospheric nuclear tests in 1953, precipitation has contained concentrations of bomb tritium (H-3) higher than the H-3 naturally deposited prior to 1953; consequently, H-3 has been used to investigate groundwater flow systems. It is a tracer for pre-1953 groundwater. A critical review of earlier uses of bomb tritium spotlights problems in its applications that may result in erroneous interpretations. The old monitoring technique using boreholes causes mixing of groundwaters of different age zones. In this study, the mixing problem is overcome by using modern monitoring devices of multi-level samplers and bundle piezometers that yield groundwater samples of small volumes at closely-spaced intervals. The old method may be used to determine recharge and discharge areas of aquifers and used where pollution poses no serious threat. Otherwise, the major pumpage of the aquifer distorts and reverses flow directions, causes mixing of different waters and may spread the pollutants. The disadvantages of the modern method include its restricted use in shallow aquifers and porous media. Case studies for use of tritium as an identifier were conducted at: an abandoned landfill site at the Canadian Forces Base, Borden, Canada; at the Whiteshell Nuclear Research Establishment, Pinawa, Canada; and at the Greenbrook Well Field in Kitchener, Ontario, Canada. The use of isotopes in hydrological studies in Africa is discussed. (Collier-IVI)
W86-01445

DECIPHERING HYDROLOGICAL SYSTEMS BY MEANS OF GEOCHEMICAL PROCESSES,
Geological Survey, Reston, VA.
B. B. Hanshaw, and W. Back.
Hydrological Sciences Journal, Vol. 30, No. 2, p 257-271, June, 1985. 1 Fig, 42 Ref.

Descriptors: *Geochemistry, *Geohydrology, *Groundwater, *Physicochemical characteristics, Carbonate rocks, Aquifers, Saline-freshwater interfaces, Calcite.

The distribution of permeability and chemical character of groundwater in carbonate aquifers is significantly influenced by the many diagenetic processes and reactions that occur in the early development of these rocks. Many of these diagenetic processes occur in the transition zone formed as the carbonate sediments emerge from the marine environment and become fresh-water aquifers. Analyses of trace elements and isotopes indicate that calcite cements and dolomites are formed in this groundwater mixing zone. Reverse reactions such as mineral dissolution and dedolomitization occur in carbonate aquifer systems. The geochemical reactivity of the fresh-water/salt-water mixing zone results from the nonlinearity of geochemical parameters as a function of ionic strength and causes extensive dissolution in coastal carbonate rocks. Interpretation of geochemical reactions and isotopic composition of groundwater provides a method to determine hydrological parameters such as porosity, hydraulic conductivity, and groundwater flow rates. This geochemical method is largely independent of the more conventional approach of determining these parameters by an evaluation of physical properties of aquifer systems. (Author's abstract)
W86-01448

WATER FLOW AND SWELLING PRESSURE IN NON-SATURATED BENTONITE-BASED CLAY BARRIERS,
Luleaa Univ. (Sweden).
L. Borgesson.
Engineering Geology, Vol. 21, No. 3/4, p 229-237, June, 1985. 9 Fig, 5 Ref.

Descriptors: *Bentonite, *Groundwater barriers, *Swelling pressure, Permeability, Water flow, Barriers, Groundwater management, Groundwater pollution, Model studies.

Experiments were devised to determine the water uptake of 10 and 20% bentonite-sand mixtures and of 100% pure bentonite. The swelling pressure situation in an unsaturated clay barrier is very complex especially when the degree of saturation varies through the barrier, and when the access to water is restricted. A piece of bentonite can be highly saturated, and yet it will not exert any pressure on a surrounding stiff material, if it has no further access to water, and if it has been allowed to swell enough to transfer the pressure to something that might be seen as a negative pore pressure. It is necesary to find the influence of the degree of saturation on the swelling pressure in a small clay element, to be able to estimate the pressure in a more complex situation. The swelling pressure reaches a peak value after a relatively short time and then approaches a slightly smaller constant value. The peak value is probably due to either released elastic stresses in the sample, or to the fact that the degree of saturation is very high near the water inlet at the beginning of the test, before the water content is equalized. An equation is derived which serves as a useful model to describe water flow, if there is no temperature gradient. The water diffusion constant in this equation must be determined using the correct initial water content. The model gives better results if the material is partly saturated, than if it is dry. The swelling pressure is a linear function of the degree of saturation. (Baker-IVI)
W86-01455

CARBONATE CHEMISTRY OF RECENT CHALK GROUNDWATER IN A PART OF EAST ANGLIA, U.K.,
Birmingham Univ. (England). Dept. of Geological Sciences.
J. A. Heathcote.
Journal of Hydrology, Vol. 78, No. 3/4, p 215-227, June, 1985. 2 Fig, 3 Tab, 28 Ref.

Descriptors: *Groundwater, *Carbonates, *Chalk Aquifer, *England, Aquifers, Alkalinity, Hydrogen ion concentration, Carbon radioisotopes, Carbon dioxide, Dissolution, Chemical properties.

An example of apparent open-system dissolution is described from a region where a limestone aquifer is recharged through thick calcareous soils developed on till. Groundwaters in the area have higher alkalinities and lower pH-values than are generally reported for carbonate terrains, apparently as a consequence of open-system dissolution. However, limited C-13 isotope data are incompatible with this conclusion, indicating that exchange with the gas phase does not control the isotope chemistry and therefore that the system is isotopically closed. This paradox can be resolved if the dynamics of the system are considered; it is shown that back-diffusion of gas from the solution to the gas reservoir is prevented and therefore isotopic equilibrium between gas and solution is not achieved. Isotope data also show that limited transfer of carbon between soil water and soil calcite occurs. (Author's abstract)
W86-01470

ESTIMATING INTERFACE ADVANC TO ABRUPT CHANGES IN REPLENIS IN UNCONFINED COASTAL AQUIFER
Queensland Univ., Brisbane (Australia). Civil Engineering.
L. T. Isaacs.
Journal of Hydrology, Vol. 78, No. 3/4, p June, 1985. 5 Fig, 4 Tab, 4 Ref.

Descriptors: *Coastal aquifers, *Saline-fr interfaces, *Replenishment, Dimensional Saline water wedge, Mathematical e Aquifers.

Dimensional analysis is used to establish tional relationship between the interface tion and the other parameters for a one-di al, unconfined, coastal aquifer subjected t decrease in replenishment. Non-dimensiona for the motion of the toe of the salt-wate for some cases are presented. The curv developed from accurate numerical solutio equations for motion of the interface an used for reliable estimates of the response faces under the conditions assumed for th ses. An approximate formula for the rate ment of the toe is derived for the special ca replenishment reduces to zero. (Author's
W86-01474

INVESTIGATION OF THE RELATI TWEEN FISSURE FLOW AND DEG CONTACT AREA BY AN ELECTRI LOGUE MODEL,
Imperial Coll. of Science and Technology, (England). Div. of Engineering Geology.
G.-A. Tselentis.
Journal of Hydrology, Vol. 78, No. 3/4, p June, 1985. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Geological fractures, models, *Geohydrology, Groundwater mo Contact area, Model studies, Flow rate.

Fissures in rock masses are a common f the near-surface layers of the Earth's crus many situation they form the primary con water movement. The hydraulic behavior fissure systems is very important to many nical activities such as pumping, where it tant to know how the hydraulic properti fissure will change under conditions of in effective stress and thus increasing cont The degree of contact area in a fissure p function of the rock stress across the plane elastic properties of the rock surface. A kn of the relation between fissure flow rate contact area of a fissure is very important, ly when dealing with soft rocks. An ele conductive paper analogue was used to fluid flow through a partially closed fissur flow rate for various degrees of contract estimated. The existence of contact areas fissure results in a decrease of flow rate decrease is a function of the contact area the rock surfaces. (Moore-IVI)
W86-01477

STUDY OF THE HYDROGEOPH PROPERTIES OF FISSURED AQ USING A DOUBLE POROSITY MODEL
Imperial Coll. of Science and Technology, (England). Div. of Engineering Geology.
G.-A. Tselentis.
Journal of Hydrology, Vol. 78, No. 3/4, p June, 1985. 6 Fig, 1 Tab, 25 Ref.

Descriptors: *Geological fractures, * *Geophysics, *Porosity, Permeability co Geophysical formation logs, Hydraulic pr Electrical properties, Cementation factor.

The purpose of this paper is to examine extent the hydrogeophysical properties of aquifers can be derived from geophysi alone. To do this a theoretical double model based on a tortuosity-free, parallel

h assumption is introduced and is used to
possible relations between geophysical
ers that can be measured from conventionhysical formation logs and the hydraulic
ristics of the aquifer. The relation between
ation's cementation factor and the electrierties of the water and the solid particles
rmation is investigated and the results are
for three different types of geologies. Fi- expression for assessing the aquifers hyconductivity from parameters measured
ophysical formation logs is derived. (Austract)
78

ICAL MODEL OF COMPACTION- GROUNDWATER FLOW AND HEAT ER AND ITS APPLICATION TO THE HYDROLOGY OF INTRACRATONIC NTARY BASINS,
/niv. at Urbana-Champaign. Dept. of Ge-
hke.
f Geophysical Research, Vol. 90, No. B8, 28, July, 1985. 8 Fig, 1 Tab, 84 Ref, 3

rs: *Mathematical models, *Groundwatnent, *Heat transfer, *Paleohydrology, tary basins, Aquifers, Geothermal gradithermal pressuring, Conduction, Hydrauties.

umerical method allows calculation of n-driven groundwater flow and associatransfer in evolving sedimentary basins. el is formulated in Lagrangian coordiconsiders two-dimensional flow in heter- anisotropic, and accreting domains. continuity of the deforming medium and al pressuring are explicitly taken into calculation of compaction-driven flow lution of an idealized intracratonic sediasin including a basal aquifer predicts ndwater movement over long time peris in shallow sediments tend to move ward the sedimentation surface, and ds move laterally. The hydraulic potennt with depth reverses itself near the er, and fluids in this area have a tendente obliquely into stratigraphically lower Only small excess pressures develop, that intracratonic basins are not subject ssuring during their evolutions. Owing ll fluid velocities, heat transfer is conminated, and the geothermal gradient is ed. Variational studies show that excess potentials, but not fluid velocities, assumptions of permeability and that s potentials and velocities scale with on rate. Aquathermal pressuring is count for < 1% of the excess potential during compaction. These results cast oles of compaction-driven flow within c basins in processes of secondary pegration, osmotic concentration of sedirines, and formation of Mississippi ore deposits. Results might also be vith chemical models to investigate the of compaction flow to cementation in Author's abstract)

/ATER AT HOME AND ABROAD,
Univ. (England). Dept. of Civil Engi-
on.
he Institution of Water Engineers and ol. 39, No. 3, p 271-283, June, 1985. 8 4 Ref.

*Aquifer properties, *Model studies, r movement, Saline water intrusion, r recharge, Hydrochemistry, Great ia, Wells, Boreholes, Groundwater

ndwater situations are considered in the Indian Subcontinent. Particular given to the differing types of wells s, the estimation of recharge, and the important features of aquifers. A discussion is also presented of problems that have arisen during exploitation of groundwater including over exploitation, waterlogging and saline intrusion. As no two aquifers are alike, the approach must be varied for each. Although routine field investigations are needed for each study, there are usually certain key features that need to be identified before an adequate understanding can be gained. Identifying the key features is usually the difficult part of the study. In the Lower Mersey Sandstone aquifer it was important to identify the following consideration: before significant abstraction occurred there were many active springs; the actual recharge was less than the potential recharge due to the influence of the drift cover; the ingress of saline water from the Mersey Estuary allowed fresh water to be released for abstraction; hydrochemical information usually reflected conditions in the aquifer several hyundreds of years ago. For the Mehsana area aquifer the following features appear to be significant: only small quantities of water can move laterally through the aquifer; significant verical flow is occurring through the clay layers; and leakage through the beds of canals and water courses is likely to produce a significant increase in the recharge. In a regional groundwater study it becomes important to attempt to fit together the various aspects throughout the study. (Baker-IVI)
W86-01524

HYDROGEOPHYSICAL MODEL FOR RELATIONS BETWEEN ELECTRICAL AND HYDRAULIC PROPERTIES OF AQUIFERS,
Geofyzika N.E., Geologicka, Barrandov (Czechoslovakia).
O. Mazac, W. E. Kelly, and I. Landa.
Journal of Hydrology, Vol. 79, No. 1/2, p 1-19, 1985. 12 Fig, 1 Tab, 38 Ref.

Descriptors: *Aquifer characteristics, *Hydraulic properties, *Electrical properties, Groundwater, Model studies, Hydrologic models, Groundwater flow.

Factors affecting relations between the geoelectric and hydraulic properties of aquifers are considered. The reliability of relations between electrical and hydraulic aquifer parameters depends primarily on two factors: the character of the material-level relationship; and the mutual relation between the direction of groundwater flow, layering and the hydrogeophysical conditions in the aquifer. The sources of errors in determining the basic geoelectric and hydraulic parameters in a set of measurements were analyzed. The necessity of applying a statistical criterion for determining the minimum number of parametric points was stressed. Both direct and inverse material-level relationships can exist depending on the rock type and the character of the hydraulic conductivity. Inverse relationships can be expected when porosity controls variations in hydraulic conductivity and other factors such as grain size, sorting, and clay content are relatively constant. Direct relationships appear to be controlled by inverse correlations between grain size and porosity or inverse correlations between clay content and hydraulic conductivity. A general hydrogeophysical model was used to demonstrate that at the aquifer scale a variety of relations may be expected. (Baker-IVI)
W86-01653

IDENTIFICATION OF PARAMETERS IN UNCONFINED AQUIFERS,
Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.
K. Sridharan, R. Ramaswamy, and N. S. Lakshmana Rao.
Journal of Hydrology, Vol. 79, No. 1/2, p 73-81, July, 1985. 5 Fig, 13 Ref.

Descriptors: *Aquifers, *Pumping tests, *Parameter identification, Optimization, Permeability coefficient, Storage, Specific yield, Sensitivity analysis, Least squares method.

A method is presented for identification of parameters in unconfined aquifers from pumping tests, based on the optimization of the objective function using the least squares approach. Four parameters are to be evaluated, namely: the hydraulic conductivity in the radial and the vertical directions, the storage coefficient and the specific yield. The sensitivity analysis technique is used for solving the optimization problem. Besides eliminating the subjectivity involved in the graphical procedure, the method takes into account the field data at all time intervals without classifying them into small and large time intervals and does not use the approximation that the ratio of the storage coefficient to the specific yield tends to zero. Two illustrative examples are presented and it is found that the parameter estimates from the computational and graphical procedures differ fairly significantly. (Author's abstract)
W86-01657

222RN CONCENTRATIONS AND VARIATIONS IN UNCONFINED GROUNDWATER,
Kyoto Univ., Osaka (Japan). Research Reactor Inst.
For primary bibliographic entry see Field 2K.
W86-01658

EFFECT OF INCOMPLETE RECOVERY PRIOR TO A PUMP TEST IN A LARGE-DIAMETER WELL,
National Geophysical Research Inst., Hyderabad (India).
C. P. Gupta, and V. S. Singh.
Journal of Hydrology, Vol. 79, No. 1/2, p 141-144, July, 1985. 3 Fig, 2 Ref.

Descriptors: *Wells, *Pumping tests, Aquifer characteristics, Water supply development, India, Water level.

In order to have a quick appraisal of the potential of an aquifer for meeting the irrigation needs of small farms and for supplying drinking water in the hard rock terrains of South India, short duration pump tests are carried out. A reliable estimate of hydrogeologic parameters was obtained through a pump test provided the recovery rate prior to the test is fed into a numerical model used for the interpretation of the data. In order to account for the effect of incomplete recovery it is necessary to observe not only the water level variations prior to the onset of pumping but also during the post pumping phase until the recovery is nearly complete for a correct interpretation of pump test data to be made. An appreciable aquifer response is observed only during recovery. The data on the recovery phase of the pump test are, therefore, necessary for the data analysis using the numerical method. Particularly the later portion of the recovery phase is more important, as the effect of prepumping incomplete recovery is pronounced in the latter portion only. (Baker-IVI)
W86-01664

MEASUREMENT OF GROUNDWATER RECHARGE ON EASTERN LONG ISLAND, NEW YORK, U.S.A.,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
T. S. Steenhuis, C. D. Jackson, S. K. J. Kung, and W. Brutsaert.
Journal of Hydrology, Vol. 79, No. 1/2, p 145-169, July, 1985. 9 Fig, 6 Tab, 27 Ref.

Descriptors: *Groundwater recharge, *Long Island, *New York, Evaporation, Hydrologic budget, Darcys law, Mathematical equations, Precipitation, Seasonal variation, Vadose zone.

Two methods were tested for their suitability to provide improved estimates of recharge in the region of eastern Long Island (New York). The two methods tested consist, first, of measuring recharge with a direct application of Darcy's law in the vadose zone and, second, of calculating recharge by closure of the hydrologic budget equation with evaporation computed from micrometeorologic data. The recharge figure, now in general use, of 50% of the annual precipitation is a long-term average at best. The measurements of recharge, which were performed during a three-

year period, showed that the vertical flux past the 1 m depth was strongly dependent on both the time of the year and the precipitation amount. In late fall, winter and early spring a high percentage of the precipitation became recharge. During the summer months there was a small net upward movement of water past the 1 m depth. Precipitation during these months did not contribute to the annual recharge. It may be concluded from these measurements that in order to estimate recharge, special attention should be given to precipitation during the winter months. A better estimate for annual recharge than the current 50% of annual precipitation might be to take approximately 75-90% of the precipitation from October 15 until May 15. The two methods used for estimating recharge were labor intensive and required experienced technicians. Currently, one method cannot be recommended above the other. Both methods give a good estimate during the year except for the winter. The closure method using micrometeorological data gives a slightly higher estimate than the direct measurement method based on Darcy's law. (Author's abstract)
W86-01665

GROUNDWATER PROTECTION IN SAN FRANCISCO BAY AREA,
California Regional Water Quality Control Board, Oakland.
For primary bibliographic entry see Field 5G.
W86-01724

INFLOW SEEPAGE INFLUENCE ON STRAIGHT ALLUVIAL CHANNELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W86-01731

SIMULATION OF TWO-FLUID RESPONSE IN VICINITY OF RECOVERY WELLS,
Lehigh Univ., Bethlehem, PA. Dept. of Civil Engineering.
G. P. Lennon.
Journal of Hydraulic Engineering, Vol. 111, No. 8, p 1156-1168, August, 1985. 8 Fig, 1 Tab, 15 Ref.

Descriptors: *Recovery wells, *Dense fluids, *Aquifers, *Groundwater pollution, Boundary conditions, Geohydrology, Wells, Saline-freshwater interfaces, Density.

A dense fluid in an unconfined aquifer is usually removed by pumping a recovery well screened in the region of the aquifer occupied by the fluid. For many problems, the transition zone separating the dense fluid from the overlying water can be modeled as a sharp interface. When the pumping begins, the interface is drawn downward, allowing water to enter the well. The recovery process is improved if a second well is drilled and screened in the zone occupied by the water. The simultaneous pumping of water tends to cause the interface to move upward, allowing the dense fluid to be recovered at an increased rate without water entering the recovery well. The boundary integral equation method (BIEM) is used to solve the problem of the response of a dense fluid near a recovery well in a ground-water aquifer. The axisymmetric problems considered here are time-dependent and involve a nonlinear boundary condition along the free surface, as well as a nonlinear, moving interfacial boundary. The entire boundary, including the moving boundaries, are discretized into axisymmetric finite elements for evaluating the required boundary integrations. Numerical examples include pumping both fluids simultaneously as well as separately. The model is used to illustrate the design of a recovery system for the efficient removal of the dense fluid. (Author's abstract)
W86-01733

ANALYSIS OF SOME LABORATORY TRACER RUNS IN NATURAL FISSURES,
Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering.
L. Moreno, I. Neretnieks, and T. Eriksen.
Water Resources Research, Vol. 21, No. 7, p 951-958, July, 1985. 11 Fig, 5 Tab, 12 Ref.

Descriptors: *Geological fractures, *Tracers, *Model studies, Advections, Dispersion, Diffusion, Sorption, Hydrodynamics, Residence time, Solute transport, Dispersivity.

Tracer tests in natural fissures performed in the laboratory are analyzed by means of fitting two different models. In the experiments, sorbing and nonsorbing tracers were injected into a natural fissure running parallel to the axis of a drill core. The models take into account advection, dispersion, diffusion into the rock matrix, and sorption onto the surface of the fissure and on the microfissures inside the matrix. For the second mechanism, one of the models considers hydrodynamic dispersion, while the other model assumes channeling dispersion. The models take into account time delays in the inlet and outlet channels. The dispersion characteristics and water residence time were determined from the experiments with nonsorbing tracers. Surface and volume sorption coefficients and data on diffusion into the rock matrix were determined for the sorbing tracers. The results are compared with values independently determined in the laboratory. Good agreement was obtained using either model. When these models are used for prediction of tracer transport over larger distances, the results will depend on the model. The model with channeling dispersion will show a greater dispersion than the model with hydrodynamic dispersion, assuming constant dispersivity. (Author's abstract)
W86-01767

COMPONENTS OF FLOW RESULTING FROM ABSTRACTION IN A TWO-LAYERED CONFINED AQUIFER WITH NO CROSS FLOW,
Institute of Hydrology, Wallingford (England).
R. S. Wikramaratna.
Water Resources Research, Vol. 21, No. 7, p 985-989, July, 1985. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Wells, *Well storage, *Confined aquifers, Artesian wells, Pumping, Well screens, Well casings, Mathematical equations, Groundwater movement, Transmissivity.

The problem of abstraction from a well penetrating a two-layered confined aquifer, each layer being independently homogeneous, isotropic, and artesian, is considered. Three components of the total abstraction are identified: the concentration from well storage and contributions from flow in each of the aquifer layers. Analytical expressions were derived for the three components; the expressions were evaluated numerically for different parameter sets in order to investigate the transient variation in the relative importance of the components. In the initial stages of pumping, well bore storage is the dominant factor, but the contribution falls effectively to zero as abstraction progresses. The length of time during which well bore storage provides a significant proportion of the total flow is dependent on the aquifer parameters as well as on the screen and casing radius. Reduction of the screen radius results in increased drawdown and a small increase in the importance of well bore storage during the early stages of pumping. In all cases, after a sufficiently long time of pumping, the aquifer flow contribution are divided in the same proportion as the transmissivities of the two layers. (Moore-IVI)
W86-01770

MULTIVARIATE ANALYSIS AND INTERPRETATION OF THE HYDROCHEMISTRY OF A DOLOMITIC REEF AQUIFER, NORTHERN ITALY,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
E. Seyhan, A. A. van de Griend, and G. B. Engelen.
Water Resources Research, Vol. 21, No. 7, p 1010-1024, July, 1985. 12 Fig, 4 Tab, 32 Ref.

Descriptors: *Multivariate analysis, *Hydrochemistry, *Dolomite aquifers, *Italy, Hydrogeology, Isotopes, Groundwater, Chemical properties, Aquifers, Environmental tracers.

Regionalization based on multivariate s
analyses of hydrochemical data and enviro
isotopes proved most successful in differ
groundwater of different hydrogeological
within the Sasso Lungo dolomitic mounta
Northern Italy. The approach used chem
isotopic data to evaluate hydrologic p
normally determined by more tradition
niques. From field and laboratory studie
hydrochemical variables measured at 46
points, three distinct groups of water typ
differentiated, in close agreement with h
logical evidence, namely, (1) pure Sciliar
water, (2) water from volcanic deposits,
mixed water from Sciliar dolomite and
deposits. Environmental isotopes are used
port hydrogeological observations and th
chemical analyses and also to provide
additional information for futher distinc
tween hydrogeological subsystems. The da
that the dolomite aquifer discharges from t
subsystems: (1) relatively young, shallow
erately deep waters in the central part of
stock and (2) older groundwater dischargi
rims of the reef. (Author's abstract)
W86-01773

EXPERIMENTAL INVESTIGATION SOLUTE TRANSPORT IN STRA POROUS MEDIA; 1. THE NONRE CASE,
Waterloo Univ. (Ontario). Dept. of Earth
E. A. Sudicky, R. W. Gillham, and E. O. F
Water Resources Research, Vol. 21, No. 7
1041, July, 1985. 3 Fig, 22 Ref.

Descriptors: *Porous media, *Solute t
*Stratified media, Tracers, Simulation, D
Dispersion, Aquifers, Sand, Silt, Model

The migration of a nonreactive solute in
porous media was studied under controlle
tory conditions by injecting a tracer int
sand layer bounded by silt layers. The ex
tal results show a delay in the breakthrou
tracer in the effluent of the permeable sa
along with a substantial decrease in conce
after a 1-m travel distance. The strongly
and skewed shape of the breakthrough c
the layered system is in contrast to the sy
and weakly dispersed concentration patte
cally associated with homogeneous media.
of the tailing of the breakthrough measur
departure from classical Fickian transport
ent. Simulations of the experiments dem
that these effects are the result of a transi
tribution of the tracer across the strata
verse molecular diffusion and that local l
nal dispersion is only of secondary import
spreading process in such systems. These
are consistent with recent theoretical des
of dispersion in stratified aquifers. (Aut
stract)
W86-01775

EXPERIMENTAL INVESTIGATION SOLUTE TRANSPORT IN STRA POROUS MEDIA 2. THE REACTIVI
Waterloo Univ. (Ontario). Dept. of Earth
R. C. Starr, R. W. Gillham, and E. A. Sud
Water Resources Research, Vol. 21, No. 7
1050, July, 1985. 7 Fig, 13 Ref.

Descriptors: *Solute transport, *Porou
*Stratified media, Simulation, Mat
models, Strontium radioisotopes, Trace
Silt, Advection, Diffusion, Retardation.

Laboratory experiments and mathematica
tions were used to investigate the trans
reactive solute, Sr-85, through a sand laye
between two silt layers. The experiment
showed breakthrough curves that were
form to those reported in the preceeding
a nonreactive solute, but were delayed in
of appearance, had a lower peak conc
and were more highly dispersed. A mat
model that accounts for longitudinal adv
the sand layer, transverse diffusion in
layers, and retardation in both the sand

was used to simulate the experimental re-
With a trial-and-error adjustment of the re-
on coefficients, the mathematical model
good representation of the experimental
however, different parameter values were
d in order to simulate breakthrough curves
ed at different values of the pore-water
y in the sand. The use of measured retarda-
rameters in the model produced a much
fit to the data compared to that which was
d when retardation was neglected. Never-
significant discrepancies existed between
asured and simulated results, with the dis-
ies becoming greater at lower velocities. In
the excellent agreement between measured
ulated results obtained in part 1 for non-
solutes, the less satisfactory agreement
d here suggests that there is some physical
ical aspect of the retardation process that
dequately represented in the model. (Au-
stract)
776

**ATION OF USEFUL GROUNDWATER
RCES IN THE SOUTHWESTERN PART
E MOSCOW ARTESIAN BASIN UNDER
SE WITHDRAWAL CONDITIONS,**
znyi Nauchno-Issledovatel'skii Inst. Gi-
gii i Inzhenerdoi Geologii, Moscow

revskii, V. A. Polyakov, and L. A.
a.
esources, Vol. 11, No. 4, p 293-303, July-
1984. 4 Fig, 2 Tab, 11 Ref. Translated
odnye Resursy, No. 4, p 35-47, July-
1984.

ors: *Mesozoic-Cenozoic Aquifer, *Leak-
oundwater movement, *Moscow, *USSR,
basin, Selective withdrawal, Hydrogeo-
undwater depletion.

ence of leakage from the Mesozoic-Ceno-
ifer complex into the Upper Devonian
through the Neocomian-Jurassic clay
vas established from the data of hydrody-
ydrochemical, hydrogeothermal, and iso-
vestigations. A quantitative estimate made
ES-1022 digital computer of all main
f formation of useful resources with the
vithdrawal was given and it was proved
than half of withdrawal is provided by
om the Mesozoic-Cenozoic aquifer com-
ul groundwater resources were estimated
year 2000, and a quantitative estimate of
es of their formation was given for this
th different variants of withdrawal. The
of not only keeping the existing with-
to 2000 but also of its substantial in-
almost 2-fold) by locating new intakes in
near the Sechcha channel, along the
ley, was proved. Such investigations can
mended when conducting works under
hydrogeological conditions to study the
of formation and to estimate useful
ter resources. (Baker-IV)
3

**TION OF THE EFFECTIVENESS OF
VE METHODS FOR MODELING
WATER FLOW ON DIGITAL COM-**
tate Univ. (USSR).
hberg, N. A. Mossakovskaya, and A. A.

ources, Vol. 11, No. 4, p 316-324, July-
984. 5 Fig, 10 Ref. Translated from
esursy, No. 4, p 61-69, July-August,

s: *Computers, *Model studies,
ater movement, Mathematical models,
orithms, Hydrogeology.

modeling methods on digital computers
ears have been introduced in hydrogeo-
estigations. A wide range of methods is
ded for use and is being used. At the
the effectiveness of using various meth-
fficiently elucidated in the literature.
most important characteristics of the numerical method from the standpoint of effectiveness of its technical application on digital computers are use of computer time and the size of the working field of the main storage. The computer experiments conducted on the test problems showed that with respect to computation time, the Seidel method is slightly inferior to the block iteration method, winning, however, in simplicity of the algorithm. (Baker-IVI)
W86-01805

INVESTIGATION OF THE HYDRODYNAMIC PROBLEMS OF SEEPAGE AND CONVECTIVE DIFFUSION IN INHOMOGENEOUS AND ANISOTROPIC POROUS MEDIA,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
M. G. Khublaryan, O. M. Churmaev, and I. O. Yushmanov.
Water Resources, Vol. 11, No. 3, p 185-191, May-June, 1984. 5 Fig, 16 Ref. Translated from Vodnye Resursy, No. 3, p 23-29, 1984.

Descriptors: *Groundwater level, *Seepage, *Diffusion, *Hydrodynamics, Porous media, Convection, Anisotropy, Mathematical equations.

The problem of predicting the groundwater level is becoming ever more urgent in connection with the increasing anthropogenic impact on rivers and subsurface waters. Transfer of part of the runoff from one river basin to another and the creation of reservoirs and other hydraulic structrues is leading to a change in the paramters of flow which in turn causes a change in the groundwater level of adjacent territories. Few investigations have been performed in which fluid flow in inhomogeneous media is studied. This work is a further development of the hydrodynamic problem of seepage and convective diffusion for the case of inhomogeneous and anisotropic media. Examples are given which demonstrate how important the characteristics of a porous medium are. Schematization and assumption of physicochemical paramters as constant are not always valid. (Baker-IV)
W86-01818

FLOW OF A WELL IN AN INHOMOGENEOUS LAYERED ARTESIAN AQUIFER,
N. N. Lapshin.
Water Resources, Vol. 11, No. 3, p 192-203, May-June, 1984. 2 Fig, 12 Ref. Translated from Vodnye Resursy, No. 3, p 30-43, May-June, 1984.

Descriptors: *Aquifer characteristics, *Wells, Water flow, Groundwater movement, Artesian wells, Permeability, Flow rate, Water table, Hydrogeology.

Inhomogeneous layered media with complete consideration of two-dimensionality in the section of the groundwater flow in each of the layers composing the aquifer were studied theoretically. An artesian aquifer is examined which consists of two zones of different permeability. The length of the filter of the pumping well amounts to only part of the thickness of one of the layers of the two-layer aquifer. The main hydrogeologic parameters of a two-layer aquifer to be determined when conducting experimental seepage flow studies are the total value of transmissivity T and pressure conductivity factor, as well as the permeability coefficients of the layers composing the aquifer. It is necessary to determine these indices considering the main properties of groundwater flow during pumping in inhomogeneous aquifers. Flow imperfection of wells due to partial penetration in an inhomogeneous two-layer aquifer is determined to a considerable extent by the pressure conductivity factor. (Baker-IVI)
W86-01819

ESTIMATION OF SAFE GROUNDWATER YIELD WITH CONSIDERATION OF CYCLIC VARIATION OF THE WATER WITHDRAWAL RATE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
S. Ya. Kontsebovskii, and E. I. Minkin.
Water Resources, Vol. 11, No. 3, p 204-217, May-June, 1984. 2 Fig, 4 Tab, 4 Ref. Translated from Vodyne Resursy, No. 3, p 44-59, May-June, 1984.

Descriptors: *Drawdown, *Groundwater, Water level, Mathematical equations, Safe yield, Water management, Irrigation water.

The existing methods of calculating the drawdown of the level (head) of groundwaters with periodic withdrawal are based on representing the withdrawal graph in the form of several steps. Random variations in the times of flushing, water spreading, and crop irrigations result in the form of the average long-term graph of the variation of ground water withdrawal for irrigation being rather smooth. The value of the lag depends on the relationship of the values of the maxima of withdrawal and duration of the time interval between them. The lags between the peak values of withdrawal and drawdown, which under certain conditions reach several months, can have a substantial effect on estimating the safe yield for irrigation. The value of the permissible drawdown assigned on the basis of thickness of the aquifer is not an exactly determined constant, but varies within certain limits. Consideration of the displacement of the peak values of drawdown with respect to the peak of withdrawal when estimating the safe yield can be expressed in an increase of the calculated values of the permissible drawdown to its upper limit. In certain cases, this value can probably be greater, taking into account that a brief drop of the level below the permissible value will occur in a period when the rate of withdrawal is substantially less than the peak value and probable disconnection of part of the wells will not lead to so substantial a complication of the water management situation as would occur at the height of crop irrigation. (Baker-IVI)
W86-01820

USES AND ABUSES OF WASTEWATER INJECTION WELLS IN HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
F. L. Peterson, and J. A. Oberdorfer.
Pacific Science, Vol. 39, No. 2, p 230-240, 1985. 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Injection wells, *Wastewater disposal, *Hawaii, Domestic wastewater, Well clogging, Geohydrology, Nitrogen gas, Injection well capacity, Particulate matter, Microorganisms.

During the past two decades in Hawaii, more than 500 injection wells for the disposal of domestic sewage wastewater have been constructed and operated. Thus far, contamination of potable groundwater supplies has not been a problem. Many of the injection wells, however, have not performed as designed, and aquifer clogging and reduced injection capacity have produced numerous well failures resulting in public health, legal, and financial problems. Factors most commonly responsible for the well problems have been unfavorable hydrogeology, underdesign of injection well capacity, poor effluent quality, and lack of injection well maintenance. Detailed study of clogging mechanisms in the immediate vicinity of injection wells suggests that binding of pore spaces by nitrogen gas is the most important cause of aquifer clogging. Other clogging mechanisms also operating are filtration of solid particles and growth of microorganisms. (Author's abstract)
W86-01884

GROUND-WATER RESOURCES OF TOWNER COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
P. G. Randich, and R. L. Kuzniar.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. North Dakota State Water Commission County Ground-Water Studies 36 and North Dakota Geological Survey Bulletin 79, Part III. 26 p, 5 fig, 3 tab, 51 ref.

Descriptors: *Water resources, *Groundwater, *Aquifers, Transmissivity, Recharge, Water use,

Chemical properties, Potential yield, Storage, Towner County, North Dakota.

Large quantities of water can be obtained from glacial-drift aquifers in Towner County, North Carolina. Glacial-drift aquifers occur as saturated sand and gravel deposits that range in thickness from 4 to 287 feet. These aquifers underlie about 550 square miles and contain approximately 2.8 million acre-feet of available ground water. Potential well yields range from 5 to 1,500 gallons per minute. The most extensive and productive is the Spiritwood aquifer system. Chemical quality of the water varies greatly, but the dominant cations are sodium and calcium and the dominant anions are sulfate and bicarbonate. The Pierre aquifer consists of a fractured siliceous shale that ranges from 25 to 400 feet in thickness in the upper part of the Pierre Shale. The Pierre aquifer underlies all of Towner County. Wells developed in the aquifer generally yield less than 10 gallons per minute. The chemical quality of the water in the Pierre also is highly variable. The dominant cation is sodium and the dominant anion generally is chloride. The rural population and most communities in Towner County depend on ground water as a source of supply. (USGS)
W86-01917

LEACHING STUDY OF OIL SHALE IN KENTUCKY WITH A SECTION ON HYDROLOGIC RECONNAISSANCE OF THE OIL SHALE OUTCROP IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-01918

2G. Water In Soils

NON-DARCIAN WATER FLOW IN PEAT,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
H. F. Hemond, and J. C. Goldman.
Journal of Ecology, Vol. 73, No. 2, p 579-584, July, 1985. 1 Fig, 14 Ref.

Descriptors: *Peat, *Permeability coefficient, *Seepage, Soil water, Flow discharge, Pore pressure, Darcys law, Interstitial water.

Dramatic changes in the apparent hydraulic conductivity of peat observed by several investigators during seepage-tube and auger hole tests in both recharge and depletion modes can be explained by the large elastic storativity of peat, which renders steady-state analytical methods inappropriate. Such observations alone are not inconsistent with Darcian peat behavior. A lesser degree of non-Darcian peat behavior suggested by constant head steady state experiments may be explainable in part by vertical effective stress and compressibility effects. Results of in situ conductivity tests in mires can also be affected by other factors, such as local alterations of vertical effective stress by the weight of observers. The three-dimensional, heterogeneous nature of the situation in the field further complicates analysis; for example, where large horizontal gradients are imposed on the peat by a seepage-tube test, local changes in peat-pore geometry due to changes of horizontal stresses may also occur. The accurate measurement and interpretation of peat hydraulic conductivity remains an extremely difficult problem. Darcy'a Law is seen to be appropriate for use in upper unhumified or slightly humified peats. Even in humified peats under natural conditions of constant pore-water chemistry, small hydraulic gradients, and fairly constant effective stress, the existing data may not be inconsistent with the satisfactory application of Darcy's Law. Field measurement methods which provide steady state condition and minimal alteration of effective stresses are likely to provide the most accurate information for hydrologic models. It is suggested that the minimum practicable alteration of pore pressure be a criterion for the design of methods to measure peat hydraulic conductivity under field conditions. (Baker-IVI)
W86-01359

EXPERIMENTAL MEASUREMENT OF CHANNELING OF FLOW IN POROUS MEDIA,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2F.
W86-01419

CHARACTERIZATION OF PORE SIZE DISTRIBUTIONS WITHIN SOILS BY MERCURY INTRUSION AND WATER-RELEASE METHODS,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
K. R. Olson.
Soil Science, Vol. 139, No. 5, p 400-404, May, 1985. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Soil water, *Pore size, *Pores, *Pore water, *Mercury intrusion method, *Water release method, Roots, Sand, Clay, Soil properties.

Soil pore size distributions for undisturbed, oven-dried peds were measured and interpreted using mercury intrusion porosimetry. The pore size distributions were compared with those calculated from moisture release data. A correlation between water retention difference by water-release methods and water storage pore volumes (50 to 0.5 microns) by mercury intrusion was established with an R squared = 0.58 over a variety of soil texture and bulk density ranges. Most of the variation occurred for soil samples high in either sand or clay. In addition, root-restricting class limits were developed based on volume of root size pores (200 to 10 microns) within oven-dried peds that were large enough to permit root tip and root hair penetration. (Author's abstract)
W86-01420

SLEEVE AND CASING LYSIMETERS FOR SOIL PORE WATER SAMPLING,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 7B.
W86-01422

DESIGN OF A SENSITIVE AND PRACTICAL CLOSED-TOP INFILTROMETER,
Haryana Agricultural Univ., Hissar (India). Dept. of Soils.
R. S. Malik, S. K. Sharma, and J. S. Dhankar.
Soil Science, Vol. 139, No. 5, p 452-457, May, 1985. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Infiltrometers, *Infiltration, *Soil water, Soil types, Moisture meters, Measuring instruments, Water depth.

A two-piece, closed-top infiltrometer with a 10-cm diameter was designed which measures infiltration under constant and naturally occurring low surface water head. Field tests were conducted in cultivated sandy and fine loamy soils with varying ring size, depth, and surface water head conditions. Mean cumulative infiltrations obtained with this infiltrometer are not significantly different from those with an open-top, falling-head infiltrometer at all times. Measurements with the designed infiltrometer are more reproducible, and hence fewer infiltration runs are needed to characterize the average infiltration parameters of a given area. The mean and coefficient of variation in cumulative infiltration of 60 min are 13.88 and 8.29% in sandy soil, respectively. The corresponding values for an open-top, falling-head infiltrometer are 13.56 and 17.55%, respectively. The designed infiltrometer does not present parallax and floating material problems. The time lag in taking zero time reading is reduced from 6.3 to 2.4 s. The sensitivity of the designed infiltrometer is 0.025 cm; that of a conventional infiltrometer is 0.1 cm. It is more practical, in general, and for remote areas of short water supply, in particular. Mean cumulative infiltration did not differ significantly with increasing ring size from 10- to 30-cm diameter. The coefficient of variation decreased at all times with the increase in size. The optimum outer ring depth was 10 cm, which was equal to the inner ring depth. The cumulative infiltration increased with increase in surface water head at all times, especially when it is increased in the higher range from 5 to 10 cm. (Author's abstract)
W86-01423

NOTE: THE RELATION BETWEEN D TIVITY AND SOIL-WATER DIFFUSIV
Griffith Univ., Nathan (Australia). Schoo tralian Environmental Studies.
J.-Y. Parlange, M. Vauclin, R. Haverkam Lisle.
Soil Science, Vol. 139, No. 5, p 458-4 1985. 1 Fig, 14 Ref.

Descriptors: *Desorptivity, *Soil water, vity, *Desorption, Sorptivity, Drainage tion.

In the absence of gravity, the amount removed by desorption from a soil with initial water content and constant sucti surface is proportional to 1/2. The coef proportionality is called desorptivity, by with sorptivity, for the infiltration of formula was derived relating desorptivit water diffusivity. The accuracy of the f illustrated with numerical, theoretical, a mental examples. Desorptivity is show much smaller than sorptivity, and this explains why gravity effects are normal tant much earlier for drainage than for in (Author's abstract)
W86-01424

NOTE ON THE USE OF A SIMPLE N CAL MODEL FOR VERTICAL, UNSA ED FLUID FLOW,
Warren Spring Lab., Stevenage (England J. M. Kirby.
Soil Science, Vol. 139, No. 5, p 462-4 1985. 11 Fig, 6 Ref.

Descriptors: *Numerical models, *Vert *Unsaturated flow, *Soil water, *Mode Permeability coefficient, Soil water suctio age, Clays, Soil types, Soil properties, D pretation.

The simulation of vertical fluid flow in u cells usually starts with a form of th water transport equation. The strong no of the equation creates difficulties in its Numerical techniques require small length steps to obtain a stable and accu tion. A previously published simple model overcame these difficulties but w only to soils that are not too dry; the m later extended to cover dry soils. The p published model uses an exponential appr for the unsaturated conductivity to deriv expression for vertical, unsaturated fluid the later work makes use of several e segments to approximate the unsaturate tivity, which extends the method to a w of soils and moisture contents. However, to a difficulty in the solution and can discontinuity in the predicted moisture depth profile. A method is demonstrate moving this difficulty and the resulting d ity and the method is applied to two ex drainage problems and to infiltration light clay. The method yields accurate both types of problems and the accur tained even with large time and depth should be realized that the accuracy dep the approximation of the unsaturated co and suction data; a poor choice can misleading results. The choice of approxi straightforward when the data for suctio (permeability) fall in straight lines. Whe are in the form of a continuous curve, several approximations will be needed an chosen such that the data are approximat the suction region of most interest in th (Collier-IVI)
W86-01425

CALDEP: A REGIONAL MODEL FO CACO3 (CALICHE) DEPOSITION IN WESTERN DESERTS,
San Diego State Univ., CA. Systems Ec search Group.

. Marion, W. H. Schlesinger, and P. J.
eyn.
Science, Vol. 139, No. 5, p 468-481, May,
11 Fig, 2 Tab, 44 Ref. NSF grant BRS
66.

iptors: *Geochemistry, *Calcium carbonate
ition, *Desert soils, *Soils, *Model studies,
he, Soil types, Evapotranspiration, Hydro-
cycle, Soil water.

ional model for CaCO3 deposition in desert
f the southwestern United States was devel-
nd validated. There were five major compo-
n the simulation model: a stochastic precipi-
model, an evapotranspiration model, chemi-
ermodynamic relationships, soil parameteri-
and a soil water and CaCO3 flux model.
e present climate, a cold-dry Pleistocene
, and a cool-wet (summer) Pleistocene cli-
the model predicted a shallower depth for
lcic horizon than was found in field soils.
ver, the model was compatible with field
one assumed that most pedogenic carbonate
during a cool-wet (winter) Pleistocene cli-
The model was highly sensitive to the fre-
of extreme precipitation events and to soil
olding capacity. The biotic factor played
ortant role in CaCO3 deposition through its
of soil CO2 concentrations and evapotran-
n rates. The range in predicted CaCO3
ion rates agreed with the rates for most
udies (1 to 5 g/sq m/yr); also, the model
ed an increasing rate of CaCO3 deposition
creasing precipitation, which agreed with
udies. The model is a valuable research tool
luating the role of state factors on soil
deposition. (Author's abstract)
426

AGE COEFFICIENTS FOR HEAVY

che Hogeschool Delft (Netherlands). Dept.
Engineering.
nedema.
of Irrigation and Drainage Engineering,
l, No. 2, p 101-112, June, 1985. 6 Fig, 3
ef, 1 Append.

iors: *Drainage, *Heavy land, *Soil prop-
Surface drainage, *Netherlands, *Yugo-
Tanzania, *Soil density, Rainfall, Percola-
ays, Basin clays, Soil types, Permeability
nt.

e of heavy land is largely governed by the
the hydraulic conductivity (K-value) of
il is generally too low (often K<0.01 m/
permit ready percolation of excess rain
lower depths. Under these conditions,
discharge predominantly takes the form
w drainage' - lateral interflow through
permeable toplayer and overland flow.
is presented that this type of 'shallow
discharge can be described by the linear
type rainfall-discharge model. According
nodel, the discharge at any time, t, is
dependent on the current dynamic storage
excess rain which has not yet been dis-
at time t. Results were evaluated by com-
with other methods of deriving drainage
ts and with commonly used design stand-
e studies were made of a Netherlands
basin clay land with mixed farming, of a
ian drainage of basin clay with mostly
ming (maize and wheat), and of a Tanza-
nage of sugarcane fields on heavy basin
. The proposed method yields values of
ct order of magnitude and is based on a
nodel of the drainage processes involved,
universally applicable. (Collier-IVI)
1

ADIENT PERMEABILITY MEASURE-
N A TRIAXIAL SYSTEM,
l Survey, Denver, CO.
en, R. W. Nichols, and T. L. Rice.
ique, Vol. 35, No. 2, p 145-157, June
ig, 2 Tab, 20 Ref.

Descriptors: *Permeability, *Triaxial systems, *Flow-pump method, Soil properties, Soil types, Sand, Clay, Silt, Soil water, Unsaturated zone.

Permeability measurements were conducted with the flow-pump method on sand, sandy silt and silty clay specimens in a conventional triaxial system by introducing and withdrawing water at known constant flow rates into the base of a specimen with a flow-pump, and by monitoring the head difference induced across the length of the specimen with a sensititive differential pressure transducer. The results show that the previously reported advantages of the flow-pump method, compared with conventional constant head and falling head methods, were realized for permeability measurements in conventional triaxial equipment. These advantages are that direct flow rate measurements are avoided together with the associated errors that arise from the effects of contaminants on capillary menisci and the long periods of time involved in flow rate measurements; permeability measurements can be obtained much more rapidly and at substantially smaller gradients; errors from the small intercept in the otherwise linear flow rate versus hydraulic gradient relationship, and also from seepage-induced permeability changes, can easily be recognized and avoided or minimized. The results further show that the initial transient response of a specimen that precedes the steady state condition needed for a permeability measurement can require a substantial period of time. In this study the response times varied from a fraction of a minute for a sand specimen to more than 200 minutes for a silty clay specimen. Errors in permeability measurements from this transient response can easily be avoided with the flow-pump method but not with constant head and falling head methods. (Author's abstract)
W86-01450

DIFFERENTIAL EVAPO-TRANSPIRATION FROM A CLAY SURFACE AND ITS INFLUENCE ON EQUILIBRIUM POREWATER PRESSURE,
Golder Associates, Maidenhead (England).
R. E. Gibson, M. H. Goldsworthy, and A. M. Chandler.
Geotechnique, Vol. 35, No. 2, p 181-191, June, 1985. 5 Fig, 6 Tab, 7 Ref.

Descriptors: *Evapotranspiration, *Porewater pressure, *Clay, *Groundwater movement, Settlement, Soil water, Evaporation, Transpiration.

The derivation is presented of expressions resulting from a steady state groundwater flow approach to determining the porewater pressure changes caused by modification of the rate of evapo-transpiration over limited areas of the ground surface. Solutions to the expressions have been computed for positions throughout the soil layer for a variety of shapes and sizes of affected area. The tabulated results may be used to estimate the effects for a wide range of conditions by making use of the principle of superposition. Case histories are presented in which observations of porewater pressure changes and of ground movement are compared with the values derived from the tabulated results. (Author's abstract)
W86-01451

WATER FLOW AND SWELLING PRESSURE IN NON-SATURATED BENTONITE-BASED CLAY BARRIERS,
Luleaa Univ. (Sweden).
For primary bibliographic entry see Field 2F.
W86-01455

OBSERVATIONS OF THE BEHAVIOUR OF LARGE CORES OF SOIL DURING DRAINAGE, AND THE CALCULATION OF HYDRAULIC CONDUCTIVITY,
Oxford Univ. (England). Dept. of Agricultural and Forest Science.
W. R. Kneale.
Journal of Soil Science, Vol. 36, No. 2, p 163-171, June, 1985. 5 Fig, 2 Tab, 8 Ref.

Descriptors: *Permeability coefficient, *Drainage, *Soil water, Matric potential, Macropore channels, Interstitial water, Air entry.

This paper reports observations on the behavior of large cores of undisturbed clay-loam soil during the drainage of water under an imposed step in potential. Rates of outflow and the matric potential at various points in the core were recorded during drainage. The volumes of 'macropore-channels' (large, continuous voids) were estimated to be 0.005 cu m/cu m in a subsoil sample, and 0.026 cu m/cu m in a topsoil sample from arable land. The calculated values of hydraulic conductivity were found to vary with the size of the step in potential imposed on the sample at the start of each drainage experiment. The available evidence suggested that the apparant K/Psi m relationship was influenced by the rate that air could enter the soil to replace water during drainage. The degree of restriction on air movement was affected by the initial drainage behavior, and this varied with the imposed step in potential. (Author's abstract)
W86-01467

NITROGEN MINERALIZATION IN A SEQUENCE OF HYDROMORPHIC SOILS IN A VALLEY IN THE HIGH SEMOIS (BELGIUM) (MINERALISATION DE L'AZOTE DANS UNE SEQUENCE DE SOLS HYDROMORPHES DE LA VALLEE DE LA HAUTE SEMOIS (BELGIQUE)),
Universite Libre de Bruxelles (Belgium). Lab. de Botanique Systematique et d'Ecologie.
F. Baillon, J. Herbauts, and M. Tanghe.
Acta Ecologica, Vol. 6, No. 2, p 183-192, 1985. 3 Fig, 2 Tab, 21 Ref.

Descriptors: *Nitrogen, *Mineralization, *Hydromorphic soils, *Semois, *Belgium, Humic soils, Water table, Nitrification, Vegetation, Soil water.

In the alluvial plain of the Semois (Belgium), both in situ and in vitro, nitrogen availability of humic layers was studied in relation with the yearly fluctuations of the water-table in a sequence of more or less hydromorphic soils. The fluctuations of the water-table were measured using a sequence of 15 piezometers disposed throughout a transect overlying successively a peaty grassland with Molinia caerulea, a tall-herb community with Filipendula ulmaria and a reed-bed with Phalaris arundinacea. Results show that, during the vegetation period, nitrogen mineralization is almost not affected by the degree of hydromorphy of the humic layers: nitrogen mineralization rates are not significantly different in the 3 studied sites and in every case nitrification is the dominant process. (Author's abstract)
W86-01510

COMPARATIVE WATER RELATIONS OF ADJACENT CALIFORNIA SHRUB AND GRASSLAND COMMUNITIES,
Pepperdine Univ., Malibu, CA. Natural Science Div.
For primary bibliographic entry see Field 2I.
W86-01602

ANALYSIS OF SOLUTE BREAKTHROUGH CURVES TO PREDICT WATER REDISTRIBUTION DURING UNSTEADY FLOW THROUGH UNDISTURBED STRUCTURED CLAY SOIL,
Oxford Univ. (England). Soil Science Lab.
R. E. White.
Journal of Hydrology, Vol. 79, No. 1/2, p 21-35, July, 1985. 4 Fig, 3 Tab, 29 Ref.

Descriptors: *Unsteady flow, *Clay, *Model studies, Solute transport, Soil water, Mixing, Diffusion, Interstitial water, Bypass flow, Structured soils.

Solutions of 5 or 10 mM CaCl2 were applied at constant rates of 7-14 mm/hr to the surface of large (23-cm dia. x 20-24 cm long) undisturbed cores of cracking clay soil. Cl- breakthrough was analyzed assuming a log-normal distribution of solute travel times. The resultant transfer function model (TFM) fitted the data well for moist or

prewetted cores (volumetric water content theta sub i from 0.35 to 0.49) but was inadequate for very dry cores (theta sub i approximately = 0.30) at the higher input rates. When extensive bypass flow occurred in the soil, the probability density function of solute travel times was not well represented by a log-normal distribution. The breakthrough data were also analyzed using a mixing model which postulated convective mixing of applied solution with resident soil water to form a mobile miscible volume, and diffusion of solute between the miscible and immiscible volumes of soil water. This model was used to predict the miscible volume and its change with time during unsteady flow through each core. The time-weighted average fractional miscible volume theta' sub m derived from the mixing model was in close agreement with theta sub m, calculated as the input water flux divided by the mean pore-water velocity given by the TFM. An essential feature of any model of solute transport in structured soils is the recognition of two domains of different flow characteristics which is some cases give rise to a log-normal distribution of pore-water velocities. (Author's abstract)
W86-01654

MODEL FOR NITRATE LEACHING IN UNDISTURBED STRUCTURED CLAY SOIL DURING UNSTEADY FLOW,
Oxford Univ. (England). Soil Science Lab.
For primary bibliographic entry see Field 5B.
W86-01655

SCALING THE EXPONENTIAL SOIL-WATER DIFFUSIVITY FOR SOILS FROM GHANA,
Ghana Univ., Legon. Dept. of Soil Science.
K. B. Laryea, and S. Abbenney-Mickson.
Journal of Hydrology, Vol. 79, No. 1/2, p 95-106, July, 1985. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Soil water, *Diffusivity, *Ghana, Infiltration, Mathematical equations, Soil type, Soil physical properties, Wetting.

Horizontal infiltration experiments were conducted on laboratory packed columns of six tropical soils chosen from two different ecological zones of Ghana (the coastal savannah and the forest regions). Calculated soil-water diffusivities of these soils were then fitted with an exponential regression equation to determine the values of the 'Universal' constants, alpha, gamma and beta. The scaling procedures suggested in the literature appear to be applicable to soils from Ghana. The constants alpha, beta and gamma vary according to the type of soil, sodium absorption ratio, and the scaling technique used to obtain the dimensionless soil-water diffusivity. Values obtained for alpha, gamma, and beta for these soils did not agree with those previously suggested, thus negating the proposed universality concept. The shape factor delta for the wetting profile appears to be around 0.90. (Moore-IVI)
W86-01659

INFLUENCE OF CYLINDRICAL MACROPORES ON STEADY-STATE INFILTRATION IN A SOIL UNDER PASTURE,
Sydney Univ. (Australia). Dept. of Soil Science.
K. R. J. Smettem, and N. Collis-George.
Journal of Hydrology, Vol. 79, No. 1/2, p 107-114, July, 1985. 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Infiltration, *Macropores, *Pastures, Permeability coefficient, Infiltrometers, Steady-state infiltration.

Steady-state infiltration rates in a soil under native pasture were predicted from independent measurements of macropore volume fluxes and soil matrix hydraulic conductivity (K(sat)). K(sat) was measured by two methods which give slightly different results but were lower than areally averaged macropore fluxes. The predicted steady-state infiltration rates were compared with data obtained from cylinder infiltrometer measurements and agreement was excellent, indicating that steady-state infiltration was controlled primarily by the size and number of macropores within an infiltrometer ring. (Author's abstract)
W86-01660

PREDICTION OF STEADY-STATE PONDED INFILTRATION DISTRIBUTIONS IN A SOIL WITH VERTICAL MACROPORES,
Sydney Univ. (Australia). Dept. of Soil Science.
K. R. J. Smettem, and N. Collis-George.
Journal of Hydrology, Vol. 79, No. 1/2, p 115-122, July, 1985. 2 Fig, 3 Tab, 8 Ref.

Descriptors: *Infiltration, *Macropores, *Ponding, Simulation, Infiltrometers, Soil water, Permeability coefficient, Mathematical models, Soil properties.

A Monte Carlo simulation is used to predict the distributions of steady-state infiltration rate values for different infiltrometer ring sizes in a soil with vertical macropores. The simulation requires functional characterization of flow in soil macropores, coupled with a knowledge of macropore spatial dispersion. An additional option includes soil matrix hydraulic conductivity K(sat) which is assumed to be normally distributed with a known mean and standard deviation. The model was checked against measured data for two different ring sizes (0.071 and 0.0022 sq m) and good agreement was obtained. It is shown that in soil with vertical transmission macropores, the distribution of steady-state infiltration rate values becomes increasingly skewed as ring size is decreased, unless K(sat) is of sufficient magnitude to mask the macropore contribution. A method for determining the probability of a sensor with a known horizontal cross-sectional soil contact area intercepting at least one macropore is also presented. (Author's abstract)
W86-01661

LEACHING FRACTION BEYOND DEPTH X, CAUSED BY PERCOLATION OF A SOIL PROFILE WITH AN INITIAL SALT ACCMULATION AT ITS SURFACE,
Central Soil Salinity Research Inst., Karnal (India).
S. K. Gupta, D. Ramadurgaiah, and W. H. Van Der Molen.
Journal of Hydrology, Vol. 79, p 123-126, 1985. 1 Ref.

Descriptors: *Leaching, *Soil water, *Path of pollutants, *Percolation, Saline soils, Salts, Solute transport.

In many saline soils, large amounts of soluble substances are accumulated at the surface by capillary rise followed by evaporation. If such a soil is leached by rainfall or by application of irrigation water, these accumulated salts will move downward. By sampling the soil after a certain time, the concentration depth relation is obtained which can be used to find the parameters describing the leaching process. A characteristic for the progress made in leaching is the fraction of solute that moved beyond a certain depth x at the moment of sampling. An expression is derived for the leaching of a profile with a superficial accumulation of soluble substances. Use has been made of existing analytical solutions, now adapted to a Dirac delta function input of solute. With the concentration profile obtained, a formula follows for the fraction of solute leached beyond depth x at a given time t. (Baker-IVI)
W86-01662

OPERATIONAL RANGES FOR SUCTION LYSIMETERS,
Kaman Tempo, Santa Barbara, CA.
L. G. Everett, and L. G. McMillion.
Ground Water Monitoring Review, Vol. 5, No. 3, p 51-60, 1985. 12 Fig, 36 Ref. EPA contract 68-03-3090.

Descriptors: *Suction lysimeters, *Lysimeters, *Monitoring, *Aeration zone, Vadose water, Land treatment, Waste disposal, Soil water.

Four questions relative to suction lysimeter performance have been raised by operators of land treatment systems. These questions deal with plugging of the porous segments of the lysimeters, soil suction operational ranges, adsorption onto and screening by the materials comprising the lysimeter parts, and loss of volatile organic negative pressures. The physical operatic lysimeter, the characteristics of the ly tested (high- and low-flow lysimeters with ceramic cups and lysimeters with porous (polytetrafluoroethylene) cups, and proced lowed in preparing them for testing are scribed and the results of experiments deali the first two questions - plugging and ope ranges - are discussed. The intake rate of lysimeters placed in the vadose zone, in mo of soils, will initially drop off rapidly, stabilize after about 15 liters of moisture ha drawn through the porous cups. Packing a line silica flour slurry around the cups o lysimeters negates most of the plugging as with finer particles in soils. The effective o range of ceramic lysimeters is between 0 centibars of suction independent of the use flour. The operating range of PTFE ly without silica flour is extremely narrow, the use of silica flour is extended to about bars of suction. The testing program indica all lysimeters should be checked for leal pressure techniques before field installat that lysimeters have 'dead' spaces, or reser from 34 to 80 mL of moisture that ca extracted from the cups, which must be ta account when determining moisture c rates. Information gathered in the test pr planned for inclusion in an EPA guidanc ment entitled 'Unsaturated Zone Monit Hazardous Waste Land Treatment Unit thor's abstract)
W86-01697

FACTORS REQUIRING RESOLUTION STALLING VADOSE ZONE MONIT SYSTEMS,
Woodward-Clyde Consultants, Santa Ana,
For primary bibliographic entry see Field
W86-01701

REDISTRIBUTION OF BROMIDE BY FALL INFILTRATION INTO A CECIL LOAM LANDSCAPE,
Agricultural Research Service, Watkinsvi
For primary bibliographic entry see Field
W86-01716

EFFECTS OF TEMPERATURE, RA AND SOIL MOISTURE ON SOIL R TION AND LITTER DECOMPOSITIO SUB-TROPICAL HUMID FOREST E TEM,
North-Eastern Hill Univ., Shillong (Indi of Botany.
J. Singh.
Acta Botanica Indica, Vol. 12, p 167-173 Fig, 1 Tab, 26 Ref.

Descriptors: *Lailad, *India, *Forests, *S ration, *Decomposition, *Litter, *Rainfa water, Carbon dioxide, Nutrients, Climate al variation, Temperature effects, Subtro Leaching.

The study was conducted at Lailad, in sub-tropical humid 50 yr old forest ecosy veloped subsequent to slash and burn agric north eastern India. Carbon dioxide pr was highly correlated with temperature and soil moisture. Seasonal climatic c during the present study seem to play an i role in controlling the decomposition ra highest decomposition rates during rain indicated to the favorable effect of the av of suitable temperature and moisture cond the activity of decomposers for leaching soluble substances. The low temperature a ture conditions during winter had an uni effect on the activity of decomposers re lower rates of decomposition. The diffe weight loss in different species can be exp considering the variation of water solubl nents and the physical nature of the plan als. (Baker-IVI)
W86-01759

LITY ANALYSIS OF WATER MOVE-
IN UNSATURATED POROUS MATERI-
EXPERIMENTAL STUDIES,
outh Wales Univ., Kensington (Australia).
of Civil Engineering.
Diment, and K. K. Watson.
Resources Research, Vol. 21, No. 7, p 979-
y, 1985. 5 Fig, 11 Ref.

tors: *Porous media, *Soil water, *Infiltra-
rticle size, Water content, Wetting front,
instability, Hydrodynamics.

irst paper of this series a detailed theory
sented in which the principles of hydrody-
tability analysis were used to develop a
erturbation equation for vertical water
nt with nonsharp fronts. The second paper
ries discussed the application of this analy-
e stability of several soil water systems,
which were potentially unstable. These
redistribution following infiltration, infil-
nto a scale heterogeneous medium, and
n into a fine-over-coarse stratified profile.
instability was expected for these sys-
a noticeable trend toward instability was
the numerical results did not predict the
ce of such a condition. There was evi-
suggest that small amounts of initial water
ve a significant effect on the damping out
lities that would occur under dry initial
s. The present paper studies the effect of
ter content and grain size on wetting
ability by using a series of simple experi-
esults are presented for redistribution fol-
filtration for three porous materials, ini-
a dry condition, and for three wetting
rior to the onset of the redistribution
addition, for the coarsest of these porous
a similar series of infiltration-redistribu-
eriments is conducted with varying
f initial water present. Results are also
for the effect of initial water content of
into a stratified profile. The experiments
te clearly that even small amounts of
er have a strongly inhibiting effect on the
ent of frontal instability patterns. (Au-
ract)
9

TIC WAVE APPROXIMATION TO
ATION INTO SOILS WITH SORBING
ORES,
Univ., Charlottesville. Dept. of Environ-
ences.
ann, and K. Beven.
ources Research, Vol. 21, No. 7, p 990-
1985. 5 Fig, 3 Tab, 17 Ref.

s: *Kinematic wave theory, *Infiltra-
cropores, Soil water, Mathematical
rption, Capillarity, Gravity flow, Wet-
Soil hydraulic properties.

pores, such as dessication cracks and
rmed by roots and soil animals, are
athways for water and solutes. Macro-
s approached in this study by kinematic
y, including a sink function with regard
re flow due to sorption by the sur-
oil matrix. Infiltration into soils with
is treated as two-domain flow. The
n is the soil matrix, in which water is
o capillarity, and infiltration is ap-
by Philip's sorptivity concept. The
ain is the soil macropore system in
r moves only under gravity and flow is
by kinematic wave theory. The two-
w model is then applied to infiltration
of undisturbed soil containing macro-
e is faily good agreement between the
d the observed hydrograph. Only 18
needed to match the modeled cumula-
e to the observed one. It is assumed in
hat a uniform macropore system exists
ich the wetting front may move as a
ultitude of flow paths each of them
wn macropore flow properties might
a more realistic approach to macro-
This may account for the dispersion of
and draining fronts. The dispersion
count for the deviation of the modeled
for the observed peak, because faster responding macropores were already drained at the time the model predicted the peak. (Moore-IVI)
W86-01771

DISCRIMINATION OF SOIL PHYSICAL PARAMETERS, THERMAL INERTIA, AND SOIL MOISTURE FROM DIURNAL SURFACE TEMPERATURE FLUCTUATIONS,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
A. A. van de Griend, P. J. Camillo, and R. J. Gurney.
Water Resources Research, Vol. 21, No. 7, p 997-1009, July, 1985. 12 Fig, 1 Tab, 41 Ref. NASA contract NAS5-23450.

Descriptors: *Soil physical properties, *Soil water, *Thermal inertia, *Soil temperature, Model studies, Remote sensing, Soil surface temperature, Heat flux, Transpiration.

A coupled heat and moisture flux model was used to study the influence of soil physical parameters and moisture content on diurnal surface temperature fluctuations. The study was performed for a grass cover under summer and autumn conditions for four soil types, ranging from sand to clay. The results show that it may be possible to use the daily maximum and minimum surface temperature measurements to discriminate several soil physical characteristics, including soil moisture. Further, ignoring the lower boundary heat flux, as is usually done in thermal inertia mapping but which can vary substantially in relation to different hydrological recharge and discharge areas, may lead to significant errors in the interpretation of soil moisture, thermal inertia, and transpiration. (Author's abstract)
W86-01772

APPROXIMATE ANALYSIS OF THE BOREHOLE PERMEAMETER IN UNSATURATED SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
J. R. Philip.
Water Resources Research, Vol 21, No. 7, p 1025-1033, July, 1985. 10 Fig, 1 Tab, 21 Ref.

Descriptors: *Borehole permeameters, *Mathematical models, *Unsaturated flow, Permeameters, Unsaturated zone, Soil water, Permeability coefficient, Capillarity, Saturated zone.

An approximate analysis of the steady constant-head uncased borehole permeameter in homogeneous unsaturated soil is presented. A bulb-shaped region of saturated soil, the 'saturated bulb,' adjoins the water-filled length of the hole. The problem is solved by matching approximate models of the 'inner' saturated flow within the bulb and of the 'outer' flow in surrounding unsaturated soil. The quasilinear analysis, with sorptive number alpha characterizing the capillary properties of the soil, is applied to the outer saturated flow. Certain approximations made are geometrical, and other simplify the physics by treating gravity and capillarity as separable. The results agree well with the limited body of relevant detailed numerical solutions, and the model is consistent also with saturated flow results and formulae. In general, the capillary properties of the soil cannot be ignored: for a borehole of radius 0.05 m, the error committed in ignoring capillarity increases from 2.8 to 280% as alpha decreases from 10 to 0.1/m. The concepts and methods (the saturated bulb, use of the quasi-linear analysis, matching inner and outer flows) apply to a range of steady mixed saturated-unsaturated flow systems with water applied under positive hydrostatic pressure to an initially unsaturated soil mass. The study leads to some doubt about the practicality of using the borehole permeameter to measure saturated hydraulic conductivity in the absence of an independent determination of alpha. (Author's abstract)
W86-01774

SUMMER SOIL MOISTURE CONTENT AND THE WATER TABLE IN A FORESTED WETLAND PEAT,
Toronto Univ. (Ontario). Dept. of Geography.
D. S. Munro.
Canadian Journal of Forest Research, Vol. 14, No. 3, p 331-335, June, 1984. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Soil water, *Water table, *Peat, *Wetlands, Beverly Swamp, Ontario, Soil moisture deficiency, Storage capacity, Swamps.

Soil samples were collected from the peat of the Beverly Swamp (Ontario), at weekly intervals, over three successive summers. The samples were analyzed to determine the distribution of soil moisture within the peat above the water table. A calculation scheme for the soil moisture deficit is defined and utilized to describe the behavior of the soil moisture regime over time. Linear regressions of soil moisture deficit against water table level are found to be statistically strong, but the slopes of the regressions change significantly from one summer to the next. Therefore, it is concluded that the position of the water table is not necessarily consistant indicator of storage capacity in wetlands. (Author's abstract)
W86-01779

EFFECT OF ENTRAPPED AIR ON WATER PERMEABILITY OF SOILS (THEORY AND EXPERIMENT),
Kiev State Univ. (USSR).
B. A. Faibishenko.
Water Resources, Vol. 11, No. 4, p 304-315, July-August, 1985. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil moisture, *Permeability coefficient, *Entrapped air, Unsaturated soils, Aeration, Water table, Model studies, Computers, Percolation.

The permeability of soils can be substantially affected by entrapped air, which remains in unsaturated soils of the zone of aeration and in quasi-saturated soils of the aquifer, reducing their permeability coefficient by 100 times and more. A model incorporating a system of equations should be used to predict water transport with consideration of entrapped air with a computer. For drainage conditions it is advisable to use in the zone of seasonal water table fluctuations in hydrogeological calculation the permeability coefficient and function K determined at the maximum possible volume of entrapped air for the investigated soils. Processes for moisture transport and percolation in the case of complete saturation and in a quasi-saturated state are described by one differential equation, the parameters of which vary for a different degree and character of soil saturation. During intake of water in monoliths under lab conditions and in rings and pits under field conditions the general character of variation of soil permeability with time is the same. Field methods can be used for determining the permeability coefficient of soils only with monitoring of the volume of entrapped air and spatial dynamics of water in soils. For practical purposes a combined approach can be recommended, which calls for: a field experiment - water intake tests in a pit for establishing the regularities of formation of the flow under natural conditions; a laboratory experiment - experiments on monoliths for determining the permeability coefficient as a function of the volume of entrapped air and hydrophysical properties of the soils and a computational experiment on a computer using a model for substantiating the necessary amount of field and lab works and for selecting and evaluating the correspondence of the mathematical model used to the natural process of percolation and moisture transport. (Baker-IVI)
W86-01804

ESTIMATION OF THE DEGREE OF DRAINAGE OF A TERRITORY,
Industrial and Scientific-Research Inst. for Engineering Surveys in Construction, Moscow (USSR).
V. V. Vedernikov, and E. S. Dzektser.
Water Resources, Vol. 11, No. 3, p 217-223, May-

June, 1984. 3 Fig, 12 Ref. Translated from Vodnye Resursy, No. 3, p 60-67, May-June, 1984.

Descriptors: *Drainage, *Mapping, *Hydrogeology, Groundwater, Hydrology, Mathematical equations, Geomorphology, Climate.

The degree of drainage of a territory is one of the most important complex hydrogeologic characteristics. The construction of hydrogeologic maps with zones of various degrees of drainage is widely used in reclamation engineering. An estimation of the degree of drainage of territories is important for planning cities, industrial complexes, routes of oil and gas pipelines or when developing areas for industrial and civil construction. The degree of drainage of a territory depends on a whole set of conditions: geomorphologic, hydrogeologic, geologic, and hydrologic-climatic. The proposed method, based on quantitative drainage criteria, broadens the limits of applicability of existing methods in view of the comparatively greater detail of the natural conditions of the investigated territories and possibilities for future use. (Baker-IVI)
W86-01821

COMPARISON OF THREE FIELD METHODS FOR MEASURING SATURATED HYDRAULIC CONDUCTIVITY,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
D. M. Lee, W. D. Reynolds, D. E. Elrick, and B. E. Clothier.
Canadian Journal of Soil Science, Vol. 65, p 563-573, August, 1985. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Permeability coefficient, *Permeameters, Measuring instruments, Sand, Loam, Clay, Macropores, Air entrapment, Soil type, Statistical studies.

The saturated hydraulic conductivity, Ks, was measured on a loamy sand, a fine sandy loam, a silt loam and a clay at four 100-sq m-area sites in southern Ontario. Twenty measurements of Ks, were obtained by each of three different measurement techniques at each of the four sites. The techniques included: (1) the air-entry permeameter method; (2) the constant head well permeameter method using the Guelph Permeameter; and (3) the falling-head permeameter method applied to small soil cores. The Ks data were found to be better described by the log-normal frequency distribution than by the normal frequency distribution. Statistical comparison of the mean Ks values (Ks) indicated significant differences between some or all of the methods within each site. This site-method interaction was interpreted in terms of the influence of macropores and air entrapment on each of the measurement techniques. The measured Ks values ranged over an order of magnitude on the sand, one to two orders of magnitude on the loams, and three orders of magnitude on the clay. The Ks estimates averaged over the three methods were: 0.00003 m/s for the sand; 0.000002 m/s for the loams and 0.0000001 m/s for the clay. Although all techniques were able to discriminate between the three soil types, the best choice of method for any particular situation appears dependent on the required type and accuracy of the Ks measurement, soil type, and the various practical constraints on the investigation. (Author's abstract)
W86-01909

2H. Lakes

POSSIBILITIES OF OBTAINING ZOOPLANKTON FROM THE RIVER PLONIA TO FEED YOUNG FISH,
Akademia Rolnicza w Szczecinie (Poland). Dept. of Hydrozoology.
B. Szlauer.
Acta Hydrobiologia, Vol. 25/26, No. 2, p 165-171, 1983/1984. 3 Tab, 12 Ref.

Descriptors: *Fish food, *Zooplankton, *River Plonia, *Poland, Fish, Aquaculture.

Little information is available on the occurrence of zooplankton at some distance from the outflows of rivers from lakes. A test method was proposed to elaborate on this problem which would allow the size of expected catches of zooplankton in a river to be estimated. Two sampling sites were chosen close to road bridges. Site I was 10 km from the outflow of the River Plonia from Lake Miedwie in a straight line. Site II was 18 km from this lake. The mean zooplankton flow at Sites I and II was respectively 74.86 and 57.88 kg wet weight per 24 hrs, ranging from 500 kg per 24 hr in May (Site I) to 0.32 kg/24 hr in August (Site II). During the period of demand for zooplankton, December to May, the zooplankton flow at Site I amounted to 23 310 kg. This was sufficient live food for the rearing of approximately 4000 kg of fry. The results of this study indicate it is possible to catch zooplankton in rivers flowing from lakes. This zooplankton may be caught even at a great distance from the lake, in those places most suitable from the point of view of their utilization. However, the catches may be abundant at such distant sites only in the period from November until May. (Baker-IVI)
W86-01320

EFFECT OF BIOTIC AND ABIOTIC FACTORS ON THE OCCURRENCE OF PLANKTONIC ROTIFERS (ROTATORIA) IN THE PLAWNIOWICE DUZE RESERVOIR (UPPER SILESIA, POLAND),
Silesian Univ., Katowice (Poland). Dept. of Zoology.
I. Bielanska-Grajner.
Acta Hydrobiologia, Vol. 25/26, No. 2, p 173-180, 1983/1984. 3 Fig, 26 Ref.

Descriptors: *Phytoplankton, *Reservoirs, *Plawniowice Duze Reservoir, *Poland, *Rotifers, Dissolved oxygen, Water temperature, Primary productivity, Population dynamics, Phytoplankton.

The Plawniowice Duze Reservoir lies in the Forest Protective Belt in the Upper Silesia Industrial Region of Poland. It was constructed by flooding a sand pit heading with waters from the Toszecki stream, a tributary of the River Klodnica. Filling was completed in 1975. The area of the reservoir is about 285 ha, with a maximum depth of 16 m, and a mean depth of 11 m. The Plawniowice Duze reservoir is a lowland, extremely limnic dam reservoir. The lake hollow is characterized by the absence of asymmetry typical for dam reservoirs. A hydrobiological investigation was carried out in the reservoir, which demonstrated a dependence between the occurrence of pelagic rotifers and phytoplankton appearing in the water body. The rotifers occurred in greater numbers at the same depths as the phytoplankton. A dependence was also noted between the vertical distibution of rotifers and the water temperature and the amount of dissolved oxygen in the water. (Baker-IVI)
W86-01321

EFFECTS OF ANNUAL DRAINING ON WATER QUALITY AND PRODUCTION OF CHANNEL CATFISH IN PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 8I.
W86-01322

APPROACH TO THE RESTORATION OF AQUATIC VEGETATION IN THE XIHU LAKE OF HANGZHOU, WITH REFERENCE TO THE WATER QUALITY PROBLEM (IN CHINESE),
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
For primary bibliographic entry see Field 5G.
W86-01324

HABITAT REQUIREMENTS AND BIOINDICATOR VALUE OF THE MAIN COMMUNITIES OF AQUATIC VEGETATION IN NORTH-EAST POLAND,
Warsaw Univ. (Poland). Dept .of Phytogeography.
S. Klosowski.
Polskie Archiwum Hydrobiologii, Vol. 32, No 1, p 7-29, 1985. 6 Fig, 3 Tab, 37 Ref.

Descriptors: *Bioindicators, *Poland, * vegetation, *Macrophytes, *Habitats, Po Indicators, Aquatic habitats, Nutrients.

Comparison of the phytosociological data as of the physical and chemical properties and substrate of the phytocenoses of five communities - Potamogetonetum perfoliat centis, P. natantis, Nupharo-Nymphaeetu and Hydrocharitetum morsus-ranae - indic the properties of the habitat evidently i phytosociological differentiation of the co ties. The substrate and water represent t great measure independent, habitat com whose importance for the various commu different. Nearly each aquatic vegetation nity, singled out on the grounds of florist ance, exhibits some indicator value. With to aquatic habitat, the greatest bioindicator displayed by Potamogetonetum natantis indicative of waters relatively poor in (mesotrophic water). (Author's abstract)
W86-01326

SEASONAL OBSERVATIONS OF H TROPHIC ACTIVITY AND ACTIVE RIAL NUMBER IN LAKE CONSTANCE
Shinshu Univ., Matsumoto (Japan). Sc Allied Medical Sciences.
K. Kato.
Archive fur Hydrobiologie, Suppl. 66, 309-319, May, 1985. 5 Fig, 1 Tab, 33 Ref.

Descriptors: *Seasonal variation, *Prima ductivity, *Bacteria, *Lake Constance, H phic bacteria, Temperature effects, Phytop Eutrophication.

In situ experiments were conducted during study factors regulating bacterial numb their heterotrophic activities in Lake Co Seasonal changes of heterotrophic acti substrate-active bacterial number were de using carbon-14 labeled glucose for samp from 2 m depths in the large mesotrop Glucose-active bacterial number fluctua 0.75 to 22000000 cells/ml and it amounte tween 3.5-46% of the total bacteria prese varied between 2.1 and 9800000 cells/m was low in April and increased rapidly, p the spring bloom of phytoplankton. Turno of labeled glucose decreased from around (1336 h) to the order of days (182 h) in A remained nearly constant at the level of a until 29 November when the numbers of time and Vmax were 434 hr and 0.013 mi l/h, respectively. A close correlation was between Vmax and glucose-active number. Data show that both Vmax and Vmax were correlated with temperature. response to labeled glucose did not show cant relations to primary productivity. (Ba W86-01329

SEDIMENT RESUSPENSION AND CU IN LAKE MANITOBA,
Department of Fisheries and Oceans, (Manitoba). Freshwater Inst.
B. C. Kenney.
Journal of Great Lakes Research, Vol. 11, 85-96, 1985. 7 Fig, 5 Tab, 18 Ref.

Descriptors: *Lake Manitoba, *Manitob pended sediments, *Water currents, S Phosphorus, Nutrients, Stratification, Win

Lake Manitoba is exposed to high prair that produce both surface waves and turbu currents. Large amounts of sediment spended in the water column of the prairi device has been designed to collect sa resuspended sediments in gram quantities ous depths without a fair weather bias. not thermally stratified, the currents me very shallow water in Lake Manitoba quently composed of a surface flow direct by the wind separated from a bottom la large directional skew at the interface. Th mass distribution of resuspended sediment the two layer characteristics of the lake

rticle size distribution of the suspended sedi-
as also sharply layered with sand in the
ayer and silt in the lower. The resuspended
its form a large phosphorus pool that is
lly available to support the immense algal
observed in prairie great lakes. (Baker-IVI)
341

**NTS AND TEMPERATURES IN GREEN
AKE MICHIGAN,**
l Oceanic and Atmospheric Administra-
n Arbor, MI. Great Lakes Environmental
h Lab.
iller, and J. H. Saylor.
of Great Lakes Research, Vol. 11, No. 2, p
985. 8 Fig, 1 Tab, 18 Ref.

ors: *Water currents, *Water temperature,
Bay, *Lake Michigan, Lakes, Water circu-
Vater level, Thermal statification, Stratifi-
Waves.

and water temperature recordings made
977 constitute the first long term data set
pe from Green Bay. Anticlockwise water
nts hypothesized from earlier indirect data
indicated in the current data. Cool water
uthward along the western shore while
water returns in the eastern part of the
s cyclonic pattern is disrupted and re-
uring northeasterly winds. An unexpected
was the large and consistent water
ransfer through Porte des Morts Passage
k Island Passage. Measurements showed
half of the water column egressing from
while cold hypolimnetic lake water en-
bay in the lower half. This intruding cold
th an estimated flow rate of 3,300 cu m/
g summer, supplies cool water well into
le bay southward of Chambers Island.
-water inflow is not an infrequent episod-
nenon, nor is the flow seasonally depend-
ing is enhanced dramatically by the infu-
lditional water. Periodic components are
all currents and are highly coherent with
vel fluctuations. Currents through the
sociated with water level oscillations at
ead illustrated that the phase was con-
in the frequency band of the semidiurnal
e and co-oscillating 9 hr wave, contrary
predictions. In addition, the phase of
cross the mouth was near zero for these
components, suggesting that the mod-
om friction may require adjustments.
ensional models capable of treating strat-
nd lake bay interactions are necessary to
model dynamic processes in Green
er-IVI)
2

**LANKTON DISTRIBUTION IN SAGI-
,**
Univ., Ann Arbor. Great Lakes Re-
.
rmer, and E. Theriot.
Great Lakes Research, Vol. 11, No 2, p
985. 9 Fig, 5 Tab, 19 Ref.

s: *Phytoplankton, *Distribution, *Sagi-
*Michigan, Great Lakes, Lake Huron,
te analysis, Algae, Diatoms, Eutrophica-
ation dynamics, Chlorophyta.

Bay is located on the western side of
on, extending in a southwesterly direc-
the lake into the lower peninsula of
Average conditions were measured in
lankton assemblage in Saginaw Bay in
amine movement of phytoplankton pop-
veloping in the bay. Phytoplankton as-
ariation was also discussed in relation to
nodels of Saginaw Bay phytoplankton.
aken in the spring were numerically
by diatoms. However, green algae then
for a brief period of dominance from
gh October when diatoms again became
nt taxonomic group. Cluster analysis
ne bay could be effectively divided into
s in regard to phytoplankton assem-
inner bay was typified by algal species
naw River origin and/or species typical of eutrophic waters in the Great Lakes. The outer region was typified in part by species of open Lake Huron. Unique phytoplankton assemblages were noted in Wild Fowl Bay and the area to the southwest of Oak Point. These areas are not well integrated with the rest of the bay. A possible strong nearshore effect was noted on transport of Saginaw Bay populations to Lake Huron. The nearshore effect modifies the effect of Saginaw River on the phytoplankton of the Saginaw Bay-Lake Huron system. (Baker-IVI)
W86-01345

TIME-DEPENDENT SOLUTION OF MULTI-SEGMENT MASS BALANCE MODELS OF CONTAMINANTS IN THE GREAT LAKES,
Argonne National Lab., IL. Environmental Research Div.
For primary bibliographic entry see Field 5B.
W86-01350

PARTITIONING OF HEAVY METALS (FE, MN, CD, PB, CU, ZN, CO, NI AND AS) AND P INTO SELECTIVE CHEMICAL FRACTIONS IN SEDIMENTS FROM LAKE KOJIMA (IN JAPANESE),
For primary bibliographic entry see Field 5B.
W86-01362

POPULATION DYNAMICS OF THE DEVILS HOLE PUPFISH,
Michigan Univ., Ann Arbor. School of Natural Resources.
B. Chernoff.
Environmental Biology of Fishes, Vol. 13, No. 2, p 139-147, 1985. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Population dynamics, *Devils Hole, *Nevada, *Pupfish, Model studies, Fish, Model studies, Mortality, Simulation, Water level, Seasonal variation.

A model is constructed to simulate fluctuations in monthly population sizes of the Devils Hole pupfish between January 1973 and August 1976. The strength of the proposed conceptual model is that is allows focusing on the relationship between population size and various biological and environmental factors. The model is shown to be capable of accurately predicting the population size over a 44 month period when several sources of mortality were included. The model was unable to project the long term effect of constant water-level management. The model should not be considered as an end in itself but rather as a valuable heuristic tool which can shed light on areas of needed research. A variety of biological parameters are estimated, and adult mortality is partitioned into natural and environmentally-dependent components. The simulations capture the seasonal fluctuations in population size, and only seven predicted population sizes differ from those observed by 20% or more. The model is used to make testable predictions about the life history of this species and interactions of the parameters are discussed. (Baker-IVI)
W86-01364

MIXED LAYER DYNAMICS IN A LAKE EXPOSED TO A SPATIALLY VARIABLE WIND FIELD,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
J. Imberger, and G. Parker.
Limnology and Oceanography, Vol. 30, No. 3, p 473-488, May, 1985. 17 Fig, 1 Tab, 18 Ref. Australian Water Resources Council project 80/119.

Descriptors: *Lakes, *Mixing, *Wind velocity, Lake circulation, Water circulation, Salinity, Density, Water temperature.

The formation of frontal structures in the surface mixed layer near the entrance of an embayment in a medium-sized lake were described with field measurements. The observed evolution of the fronts was interpreted in terms of three well defined dynamical regimes. The first, differential heating, is defined as the variable heat capture due to decreased surface heat losses and warmer surface water in the sheltered embayments. The second, variable deepening of the mixed layer, is induced by a sudden increase in wind speed in the open central areas of the lake, with only minimal mixing in the sheltered part of the lake. The third is the horizontal gravitational motion driven by the horizontal density gradients set up by the active deepening of the mixed layer in the exposed parts of the lake. Although detailed wind data were not available, observations of the temperature and salinity fields show the existence of fronts in lakes and strongly suggest the importance of the above mechanisms in determining the horizontal variability of these fields in the surface mixed layer of medium-sized lakes. (Author's abstract)
W86-01412

EFFECTS OF PH AND PLANT SOURCE ON LIGNOCELLULOSE BIODEGRADATION RATES IN TWO WETLAND ECOSYSTEMS, THE OKEFENOKEE SWAMP AND A GEORGIA SALT MARSH,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 2L.
W86-01413

EXPERIMENTAL MANIPULATION OF NUTRIENTS AND WATER IN A FRESHWATER MARSH: EFFECTS ON BIOMASS, DECOMPOSITION, AND NUTRIENT ACCUMULATION,
Manitoba Univ., Winnipeg. Dept. of Botany.
For primary bibliographic entry see Field 5D.
W86-01414

PHOSPHORUS LIMITATION OF LOTIC PERIPHYTON GROWTH RATES: AN INTERSITE COMPARISON USING CONTINUOUS-FLOW TROUGHS (THOMAS RIVER SYSTEM, BRITISH COLUMBIA),
National Water Research Inst., Vancouver (British Columbia). Pacific and Yukon Region.
M. L. Bothwell.
Limnology and Oceanography, Vol. 30, No. 3, p 527-542, May, 1985. 3 Fig, 7 Tab, 72 Ref.

Descriptors: *Phosphorus, *Limiting nutrients, *Periphyton, *Thomas River System, *British Columbia, Nitrogen, Nutrients, Growth, Biomass, Algae, Chemical composition.

Periphyton growth rates and relative degrees of phosphorus deficiency were compared with onsite, continuous-flow troughs in three parts of the Thompson River system. Soluble reactive phosphorus (SRP) in the lower Thompson, North Thompson, and South Thompson Rivers averaged 3.4, 1.1, and 0.7 micro-g/liter. Several physiological and chemical composition parameters ranked the degree of P deficiency in the rivers in the same sequence as did SRP. Among these were alkaline phosphatase activity, V sub max for (P-32)O4(3-) uptake, and cellular N:organic P, Chl a:ATP, C:ATP, and C:organic P. Specific growth rates (mu) estimated by biomass accrual and by (C-14)O2 uptake usually, but not always, indicated higher mu with greater availability of P. However, relative specific growth rates (mu:mu sub max) consistently reflected the influence of P limitation. As assessed from N:organic P and by application of the Droop and Goldman-Carpenter equations, mu:mu sub max was 0.8-0.9 at the lower Thompson, 0.3-0.6 at the North Thompson, and 0.0-0.3 at the South Thompson sites. Hence, periphyton growth rates in the lower Thompson River were near the maximum set by temperature and light at ambient SRP of only 3-4 micro-g/liter. Evidence of P-limited growth rates in the South Thompson and North Thompson Rivers was found at temperatures approaching 0 C. (Author's abstract)
W86-01416

FACTORS CONTROLLING PHOSPHORUS LIMITATION IN STREAM SEDIMENTS,
State Univ. of New York Coll. at Cortland. Dept. of Biological Sciences.
R. L. Klotz.
Limnology and Oceanography, Vol. 30, No. 3, p

543-553, May, 1985. 5 Fig, 6 Tab, 30 Ref.

Descriptors: *Phosphorus, *Limiting nutrients, *Stream sediments, *Sediments, *New York, Microorganisms, Benthos, Alkaline phosphatase activity, Forest watersheds, Agricultural watersheds.

Factors influencing the phosphorus limitation of benthic microorganisms were determined for four streams (two agricultural and two forested) in central New York State over an annual cycle. Phosphorus limitation was measured biweekly as specific alkaline phosphatase activity (APA) of sediment samples. Analysis of variance showed the forested streams (sites 2 and 4) to have significantly different sediment APA from the agricultural streams (sites 1 and 3), the higher APA for the forested sites indicating greater phosphorus limitation. Stream total reactive phosphorus concentrations showed no relationship with watershed type, with mean annual values of 10.5 and 6.0 micro-g/liter for agricultural sites 1 and 3 and 4.1 and 9.6 for forested sites 2 and 4. With all sites grouped together, sediment APA had a low correlation with stream water phosphate ($r = 0.184$, $n = 73$). Phosphorus sorption isotherms showed sediments from agricultural streams to have higher phosphate sorption indices than forested sites and to sorb rapidly large amounts of phosphorus. This resulted in higher available phosphorus content for the agricultural sediments and lower sediment APA. (Author's abstract)
W86-01417

DISTRIBUTION AND CHARACTERISTICS OF CARBOXYPEPTIDASE ACTIVITY IN POND, RIVER, AND SEAWATERS, IN THE VICINITY OF TOKYO,
Tokyo Univ. (Japan). Dept. of Chemistry.
S. Hashimoto, K. Fujiwara, K. Fuwa, and T. Saino.
Limnology and Oceanography, Vol. 30, No. 3, p 631-645, May, 1985. 10 Fig, 4 Tab, 29 Ref. Ministry of Science, Culture and Education (Japan) grant-in-aid 58540349.

Descriptors: *Carboxypeptidase, *Ponds, *Rivers, *Seawater, *Tokyo Bay, *Japan, *Enzymes, Chlorophyll, Proteins, Water chemistry, Peptides, Organic carbon.

Enzymatic hydrolysis of the peptide bond between glycine and tryptophan was measured in river water, pond water, and seawater near Tokyo. Enzymatic activities were in the range between 0.1 and 3 mU/liter, 10-50% of the activity was due to cell-free (dissolved) enzymes (1 mU expresses the rate of hydrolyzing substrate at 1 nM/min at 25 C). According to gel permeation chromatography, the dissolved activity included several macromolecules with molecular weights between 30,000 and 500,000 daltons. The horizontal and vertical distributions of this activity were measured in Tokyo Bay and the open sea, where an appreciable amount was detected even at 1,400-m depth. Among various factors investigated (including pH, salinity, water, temperature, metal ions, and phosphorus concentrations), total organic carbon, particulate organic carbon, and especially chlorophyll a were positively correlated to the enzymatic activity in Tokyo Bay. The slope of regressions of chlorophyll a on carboxypeptidase activity for individual sampling points showed that the activity per unit of chlorophyll a increased when the sampling station was closer to the open sea. Although whole protein molecules are not decomposed in the dissolved state, small peptides may be degraded by the free dissolved enzymes. (Author's abstract)
W86-01418

ANNUAL LOSSES OF IRON FROM MOORLAND SOILS AND THEIR RELATION TO FREE IRON CONTENTS,
Stirling Univ. (Scotland). Dept. of Environmental Science.
I. C. Grieve.
Journal of Soil Science, Vol. 36, No. 2, p 307-312, June 1985. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Iron, *Moorland soils, *Soils, Chemical composition, Metals, Organic matter, Soil properties.

The temporal pattern of iron loss from a moorland catchment was investigated by intensive stream sampling. The field site was a 51 ha area of moorland in the Ochil Hills near Stirling, Scotland, drained by a small tributary of the Allan Water. Filtered water samples were used for the determination of dissolved iron by atomic absorption spectrophotometry and of dissolved organic matter by dichromate oxidation. Losses of iron from the catchment were calculated as the product of discharge and iron concentration, summed over time. The total loss in 1 year was 2.11 kg/ha of Fe, with a pronounced autumn maximum. Iron concentrations in stream water were strongly correlated with dissolved organic matter content, but again with seasonal variation. The autumn maximum for Fe losses relates to the flushing of DOM during autumn rewetting of the catchment. However, the DOM/Fe ratio indicates maximum iron transport per unit mass of DOM in the winter. Free iron content measured on a number of soils in the catchment ranged from 3.1 to 8.7 kg/sq m. Assuming soil development over 10,000 years, predicted loss of iron from the catchment is comparable in quantity to the amounts of free iron in soils. (Collier-IVI)
W86-01468

EFFECT OF SUSPENDED SOLIDS ON THE GROWTH OF APICAL TIPS OF GAMETOPHYTE PLANTS OF LEMANEA AND ON CARPOSPORE GERMINATION AND SUBSEQUENT COLONISATION,
University Coll., Cardiff (Wales). Dept. of Plant Science.
For primary bibliographic entry see Field 5C.
W86-01498

INTER- AND INTRA-HABITAT DISTRIBUTION OF LEECHES IN A EUTROPHIC ENGLISH LAKE,
Liverpool Univ. (England). Dept. of Zoology.
S. M. L. Randall, S. M. Spelling, and J. O. Young.
Archiv fur Hydrobiologie, Vol. 103, No. 4, p 419-444, June, 1985. 12 Fig, 9 Tab, 35 Ref.

Descriptors: *Leeches, *Ecological distribution, *Eutrophic lakes, *England, Habitats, Substrate, Reproduction, Biomass, Water depth, Migration.

In an eutrophic English lake, Erpobdella octoculata, Glossiphonia complanata and Helobdella stagnalis had their maximum abundance in waters of less than 1 m in depth. H. stagnalis was numerically dominant on stones, on plants and in detritus. E. octoculata had a greater relative abundance than G. complanata on plants and in detritus. For any one species, weight-structure and breeding activity were similar for populations living on stones and in beds of vegetation. Leeches showed no preference for stones of a particular size or texture. For each of the species, density and biomass were less but mean weight and the proportion of breeding animals were greater on stones than in the underlying subtratum. There was some evidence for a movement of leeches into the deeper littoral waters in the winter. (Author's abstract)
W86-01499

RESPONSES OF PHYTOPLANKTON IN LAKE JACARETINGA TO ENRICHMENT WITH NITROGEN AND PHOSPHORUS IN CONCENTRATIONS SIMILAR TO THOSE OF THE RIVER SOLIMOES (AMAZON, BRAZIL),
Universidade Estadual Paulista, Botucatu (Brazil). Inst. Basico de Biologia Medica e Agricola.
R. Henry, K. Hino, J. G. Tundisi, and J. S. B. Ribeiro.
Archiv fur Hydrobiologie, Vol 103, No. 4, p 453-477, June, 1985. 14 Fig, 4 Tab, 40 Ref. NSF grant BSR-800.3203.

Descriptors: *Phytoplankton, *Nitrogen, *Phosphorus, *Lake Jacaretinga, *River Solimoes, *Brazil, Zooplankton, Productivity, Nitrates, Chlorophyll, Decomposition, Bacteria.

The Amazon valley presents a large dive aquatic environments, all formed by water from the Andes through the River Solimo water inflow from the river Solimoes adjacent lakes (Lake Jacaretinga for exam fects strongly the ecology and productivit lacustrine systems. An in situ enrichment ment was conducted in Lake Jacaretinga in January 1982 to assess the possible stimul phytoplankton growth by nutrients (nitr phosphates). Phosphate enrichment (with out nitrate) did not cause statistically cha the chlorophyll production. There was a cant increase in biomass (chlorophyll a) an synthetic activity after only two days inc due to nitrate addition. On day four, a dec chlorophyll and primary productivity o This reduction was explained as a fun predation by zooplankton. On day six of tion, an increase in productivity was obser probably to ammonia excretion by zoo and decomposition action by bacteria. Th of river water into the lake at high water (September) results in a rich load of nut well as an increase of the water levels in (Moore-IVI)
W86-01500

GAMMARIDS IN STREAMS OF NORT ERN BAVARIA, F. R. G. I. PREDICTI THEIR GENERAL OCCURRENCE BY S ED HYDROCHEMICAL VARIABLES,
Fachhochschule Weihenstephan, Freising ny, F.R.). Fachbereich Landespflege.
E. Schrimpff, and F. Foeckler.
Archiv fur Hydrobiologie, Vol. 103, No. 495, June, 1985. 3 Fig, 7 Tab, 21 Ref.

Descriptors: *Gammarus, *Ecological dist *Bavaria, *Germany (Federal Republic), Magnesium, Hydrogen ion concentration chemistry, Geology, Crustaceans.

Northeastern Bavaria (Federal Republic o ny) belongs to the distribution area of Gammarus species: G. fossarum and G. ro a geographical area of about 3000 sq k populated by gammarids. To determine i conditions or anthropogenic influences ca 143 stream sections within 15 selected st Northeastern Bavaria were checked for ence of Gammarus, temperature, pH and conductivity. Water samples were analyze Mg, K, Cl(-), NO3(-), PO4(3-), Fe, Zn, to ness and organic matter. The occurrence marids in this area is restricted to the well streams of the scarplands. Gammarids a acidic waters, poor in ions, of the ancien lock area and of the ferrugineous sandsto within the scarplands. Mg, Ca, and pH hydrochemical parameters most efficient crimination between the occurrence and n rence of gammarids. A simple discri model built up on these variables yields 9 rect predictions within Northeastern Bava model was less efficient when applied areas. (Moore-IVI)
W86-01501

LOWLAND HARDWOOD WETLAND TEBRATE COMMUNITY AND PRODU IN MISSOURI,
1027 Second St., Morgan City, LA, 70380.
D. C. White.
Archiv fur Hydrobiologie, Vol. 103, No. 533, June, 1985. 1 Fig, 13 Tab, 40 Ref.

Descriptors: *Wetlands, *Invertebrates, tivity, *Missouri, Isopods, Amphipods, Drought tolerance, Dissolved oxygen, Mi mate.

The invertebrate community and product lowland hardwood wetland sites in sou Missouri, were studied in the winter of 19 The 1 managed and 2 naturally flooded si in the initiation date of winter flooding. T tebrate community was classified acco strategies for drought toleration and p recruitment to the community. The dom

nt residents (isopods, amphipods and fin-
lams) indicated that lowland hardwood
retain sufficient moisture during the dry
support animals with limited drought
. Comparisons of isopod growth on the 3
cated that duration of the hydroperiod
most important factor affecting produc-
relatively low production of isopods,
ls and fingernail clams on lowland hard-
etlands is related to limited dissolved
oor water mixing and a short, cold grow-
. (Author's abstract)
2

POND DIAGNOSTIC-FEASIBILITY RECOMMENDATIONS FOR RESTOR-AKE IMPACTED BY URBAN STORM-RUNOFF,
setts Dept. of Environmental Quality En-
Westborough. Div. of Water Pollution

sebrough, and C. L. Duerring.
rm Environmental Science, Vol. 3, No.
1984. 4 Fig, 1 Tab, 19 Ref.

s: *Spy Pond, *Arlington, *Massachu-
rophic lakes, *Ponds, Lake restoration,
llution effects, Lakes, Water quality,
off, Oxygenation, Aluminum salts.

ic study was performed on Spy Pond in
Massachusetts from March 1980 to
by the Massachusetts Division of Water
Control. This lake was found to be
rophic based on high inlake nutrient
ons, anaerobic hypolimnion during
atification, successive algae blooms, and
ic macrophyte growth in littoral areas.
n drains are known to deliver urban
runoff to the lake and this was found
ajor source of nutrients. A feasibility
er examined and confirmed these re-
st-effective restoration project was de-
at incorporates the following compo-
rtation of 1 mgd of groundwater, peri-
an aluminum salt to seal the sediments,
diffuser to enhance circulation, and a
hamber at the major storm drain/inlet
lows into three separate waste streams.
stract)

CYCLING AND ECOSYSTEM BE-IN A SALT-WATER LAKE,
or Hydrobiological Research, Yerseke
s).
and C. F. Hopstaken.
Journal of Sea Research, Vol. 18, No.
45, December, 1984. 6 Fig, 4 Tab, 46

*Cycling nutrients, *Ecosystems,
ke Grevelingen, *Netherlands, Water
evelopment, Flood control, Environ-
s.

alance model is developed to describe
the relations between carbon cycling
dynamics in saline Lake Grevelingen,
uary in the SW-part of the Nether-
lations indicate nutrient limitation of
nd benthic microalgae by reversible
ore than 75% of the available silicon
in bottom detritus. Mobilization from
is the main nutrient source during
ake by benthic micro-algae strongly
utrient flux from shallow bottoms at
take of nutrients from the overlaying
nthic micro-algae during spring can
observed decrease of the dissolved
ntration in the absence of planktonic
planktonic primary production de-
balance between storage of nutrients
tritus, mineralization, and uptake by
algae. Denitrification is considered to
ess in the nitrogen balance, compen-
rogen load, and thus crucial in con-
mesotrophic properties of the lake.
ably influencing denitrification and
lling or promoting eutrophication in
e ecosystem, like the oxygen concen-

tration in the sediment and the suspension feed in bottom fauna community, are discussed. The observed gradual concentration decrease of silicon at an increasing nitrogen concentration, combined with a shift in phytoplankton from diatoms to flagellates, is explained by irreversible fixation of a small fraction of silicon in diatom tests, combined with a high resolution rate of the labile silicon fraction in detritus. (Baker-IVI)
W86-01569

PHYTOPLANKTON PRIMARY PRODUCTION IN BRACKISH LAKE GREVELINGEN (SW NETHERLANDS) DURING 1976-1981,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
F. Vegter, and P. R. M. de Visscher.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 246-259, December, 1984. 3 Fig, 4 Tab, 33 Ref.

Descriptors: *Water resources development, *Flood control, *Environmental effects, *Phytoplankton, *Primary productivity, *Lake Grevelingen, *Netherlands, Carbon, Nutrients, Temperature effects, Water temperature, Light intensity, Chlorophyll.

Phytoplankton primary production in brackish Lake Grevelingen was studied from 1976 to 1981, inclusive, in connection with a number of environmental parameters. An evident tendency of increasing primary production from 1978 (90 g C/sq m/a) to 1981 (225 g C/sq m/a) has been shown, following a change in the hydrological regime of the lake in 1978, viz. the opening of a sluice between the lake and the North Sea. Especially increased nitrate concentrations may be responsible for the enhanced production. Primary production was triggered almost every year at the end of February with prevailing light conditions of 0.002-0.004 J/sq cm/s in the water column. Annual production data from Lake Grevelingen are comparable with literature values, measured in eutrophicated coastal areas. (Baker-IVI)
W86-01570

CHANGES OF SEDIMENT DISTRIBUTION PATTERNS IN LAKE GREVELINGEN, AN ENCLOSED ESTUARY IN THE SW NETHERLANDS,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
P. Kelderman, J. Nieuwenhuize, A. M. Meerman-Van de Repe, and J. M. Van Liere.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 273-285, December, 1984. 8 Fig, 1 Tab, 29 Ref.

Descriptors: *Lake sediments, *Lake Grevelingen, *Netherlands, Environmental effects, Sedimentation, Sediment transport, Sediments, Particle size, Distribution.

Some basic sediment parameters from samples of 0 to 3 cm sediment depth were investigated at 430 stations in the recently formed Lake Grevelingen, to elucidate the history of sediment deposition in Lake Grevelingen and the former Grevelingen estuary. A geographical trend exists for the sediment median grain size, with increasing median grain size values towards the eastern part of the lake. This trend has been caused by sediment distribution processes under the former ebb and flood currents in the Grevelingen estuary. After enclosure of the estuary in 1971, much of the fine grained sediment material has been transported towards the deeper gullies. A reflection of this may be seen in the recent sediment maps for mud content and organic carbon content of the upper 0-3 cm sediment layer in Lake Grevelingen. (Baker-IVI)
W86-01571

SEDIMENT-WATER EXCHANGE IN LAKE GREVELINGEN UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
P. Kelderman.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 286-311, December, 1984. 11 Fig, 3 Tab, 69 Ref.

Descriptors: *Lake sediments, *Lake Grevelingen, *Netherlands, Sediments, Nutrients, Water temperature, Phosphates, Turbulence, Silicates, Resuspension, Model studies.

The impact of various environmental factors on the phosphate and silicate sediment-water exchange in Lake Grevelingen has been investigated in a series of laboratory experiments under aerobic conditions. Silicate mobilization from the sediment showed a strong temperature dependence, with fluxes ranging from 5 mg Si/sq m/day at 5 C to 85 mg Si/sq m/day at 20 C. Phosphate mobilization fluxes ranged from 0.5 to 11 PO4-P/sq m/day at 5 and at 20 C respectively. The phosphate exchange fluxes showed a significantly linear negative correlation with the phosphate concentrations in the overlying water, in accordance with Fick's first law of diffusion. High P accumulation rates into the sediment were especially found at low water temperatures. Resuspension of the upper sediment layer was shown to enhance these P accumulation rates even more. Based on the results for four different sediment types, general relationships have been derived for the phosphate sediment water exchange as a function of water temperature and phosphate concentration in Lake Grevelingen. The results have successfully been applied in a simulation model for the phosphate concentration in Lake Grevelingen over the years 1974 through 1977. (Baker-IVI)
W86-01572

NUTRIENT CONCENTRATIONS IN THE INTERSTITIAL WATER OF LAKE GREVELINGEN SEDIMENT: EFFECTS OF SEDIMENT REDISTRIBUTION AND BENTHIC PRIMARY PRODUCTION PROCESSES,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
P. Kelderman.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 312-326, December, 1984. 7 Fig, 2 Tab, 75 Ref.

Descriptors: *Netherlands, *Lake Grevelingen, *Sediments, *Nutrients, *Interstitial water, Benthos, Primary productivity, Oxygen, Sedimentation, Ammonia, Nitrates, Phosphorus, Silicates, Water depth.

Interstitial water characteristics are a useful indicator for the various diagenetic processes in the sediment. Nutrient concentrations in the interstitial water were periodically investigated at 24 permanent stations in Lake Grevelingen, a recently enclosed estuary in the Netherlands. At the deeper stations (>7 m) in the lake, phosphate and silicate pore water concentration generally reach maximum values in the 0-3 cm sediment zone (typically 50 and 400 microgat/l respectively). These maxima are caused by the mineralization of reactive sediment material, that is continuously being redistributed towards the deeper areas in the lake. At the shallow stations (<7 m) local phosphate and silicate porewater maxima are often found in the top 0-1 or even 0-.5 cm layer. It is probable that mineralization of microphytobenthos cells plays a dominant role here. This implies that a light dependent nutrient depletion in the upper mm, or less, of the sediment must have occurred; an effect that could not be detected with the present interstitial water sampling technique, but has indirectly been shown to take place at a field station with high microphytobenthos primary production rates. Highly significant seasonal trends were found for the P, Si and NH4-N pore water concentration in the top layer at the deeper stations. Seasonal variations at the shallow station were virtually absent; light regime, and not temperature, may be the dominant factor here. (Baker-IVI)
W86-01573

CARBON FIXATION AND CHLOROPHYLL IN BOTTOM SEDIMENTS OF BRACKISH LAKE GREVELINGEN, THE NETHERLANDS,

Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
P. H. Nienhuis, and B. H. H. De Bree.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 337-359, December, 1984. 5 Fig, 6 Tab, 44 Ref.

Descriptors: *Lake Grevelingen, *Netherlands, *Lake sediments, *Carbon fixation, Chlorophyll, Bottom sediments, Pigments, Particulates, Organic carbon, Primary productivity, Benthos.

Chlorophyll a concentrations in the upper 10 cm (sliced per cm) of Lake Grevelingen (Netherlands) sediments are given for the years 1977-1980. Chlorophyll a in the upper cm of the bottom varied between 20-400 mg/sq m. Average values in 1-3 m deep sandy and silty-sandy stations amounted to 67.5-82.2 mg/sq m in the upper cm. A 7 m deep silty station contained on an average 42.7 mg/sq m chlorophyll a in the upper cm of the sediment. Both within year and year to year variations were large. A restricted number of phaeopigment data for 1977 revealed an average phaeopigment chlorophyll a ratio of 0.03 (sand) to 0.39 (silt). Particulate organic carbon (POC) measured in 1977 and 1978 in the top cm of the sediment showed annual average values ranging between 0.2 and 0.7% of sediment dry weight. C-14 fixation data in the light, as measured in a lab incubator, are given for 1979 and 1980, with highest values during summer and lower values in winter. Integrated annual values give average C-14 fixation estimates per station ranging between 47 and 71 g C/sq m/a, with a variation coefficient of 35 to 49% of the mean. Average C-14 dark fixation values varied between 13 and 27% of average light fixation values. An arbitrarily and tentatively derived net microphytobenthos primary production estimate for entire Lake Grevelingen amounts to 35 g C/sq m for 1979 and 32 g C/sq m for 1980. The relationship between POC and chlorophyll a concentration was sometimes significant; between annual chlorophyll a concentration and light fixation values it was not. The C-14 and the oxygen exchange methods both have serious drawbacks when applied to benthic systems. (Baker-IVI)
W86-01574

DYNAMICS, MIGRATION AND GROWTH OF NASSARIUS RETICULATUS (MOLLUSCA: PROSOBRANCHIA) COLONIZING SALINE LAKE GREVELINGEN (SW NETHERLANDS),
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
R. H. D. Lambeck.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 395-417, December, 1984. 13 Fig, 3 Tab, 17 Ref.

Descriptors: *Lake Grevelingen, *Netherlands, *Snails, *Biomass, Growth rates, Population dynamics, Lakes, Migration.

The marine snail Nassarius reticulatus colonized Lake Grevelingen (Netherlands) after its creation in 1971. A population explosion took place in 1976. Dynamics, growth and biomass development were studied during 1976 and 1977. One generation a year was observed, with 1976 settlement around August 1. Densities at a 12 m deep station were mostly below 10/sq m, at two shallow (1 m) stations numbers increased to 40 to 60 sq m, as a result of immigration. Numbers at two 3 m stations, with peak values of 200 sq m, showed a cyclic pattern with a minimum in July 1977 due to migratory movements. Biomass increased over the period of investigation. The lowest maximum biomass was found at 12 m (0.16 g ADW/sq m) and the highest of 5.0 g at a 3 m station. In this survey the dominant 1976 year class showed a gradual decline from about 300 ind/sq m between 2 and 35 m to about 60/sq m in water deeper than 10 m. Growth rates were also depth dependent. Within the range of 2 to 25 m juveniles born in 1976 showed a maximum mean size of 6.8 mm after one growing season at 5 to 6 m depth against only 3.5 mm in deep water. Highest mean values after 2 growing seasons, vix. 16 mm, were reached at the 1 m deep stations, which figure might be inflated by size dependent immigration. Growth was poor (8 mm) at the 12 m station. Growth rates are similar to Swedish observations, but were reached at 10 to 50 times higher densities in Lake Grevelingen. (Baker-IVI)
W86-01575

LONG-TERM EVOLUTION OF THE MEIOFAUNA AT A SANDY STATION IN LAKE GREVELINGEN, THE NETHERLANDS,
Ghent Rijksuniversiteit (Belgium). Zoology Inst.
K. A. Willems, Y. Sharma, C. Heip, and A. J. J. Sandee.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 418-433, December, 1984. 4 Fig, 4 Tab, 21 Ref.

Descriptors: *Lake Grevelingen, *Netherlands, *Population dynamics, *Nematodes, *Copepods, Crustaceans, Species diversity, Species composition, Biomass, Vertical distribution.

Data on density, diversity and species number of harpacticoids and nematodes from a 3 m deep station in Lake Grevelingen are reported over the period 1975-1980. Vertical distribution of both copepod and nematode densities are added. Over the 6 year period 95 species of nematodes and 26 species of harpacticoids have been identified. Neither diversity nor species number of harpacticoids changed significantly over the period. Nematode diversity and species number showed considerable changes, and especially the species composition evolved drastically over the years. The changes in feeding types among nematodes are discussed. Densities of both copepods and nematodes changed substantially over the 6 year period. Concurrent with a significant rise of the redox discontinuity layer from more than 20 cm sediment depth to less than 5 cm, the interstitial copepod fauna disappeared almost completely. The changes in vertical distribution of nematode densities were less pronounced though substantial. (Baker-IVI)
W86-01576

DENSITY, GROWTH AND ANNUAL FOOD CONSUMPTION OF PLAICE (PLEURONECTES PLATESSA L.) AND FLOUNDER (PLATICHTHYS FELSUS (L.)) IN LAKE GREVELINGEN, THE NETHERLANDS,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
G. Doornbos, and F. Twisk.
Netherlands Journal of Sea Research, Vol. 18, No. 3/4, p 434-456, December, 1984. 6 Fig, 7 Tab, 34 Ref.

Descriptors: *Lake Grevelingen, *Netherlands, *Population dynamics, *Fish, Plaice, Flounder, Saline lakes, Growth, Fish food.

Within the scope of a carbon budget study in the 108 sq km saline Lake Grevelingen, investigations on the plaice and flounder populations were made during October 1979 to December 1981. Both populations were dominated by the 1979 year class that presumably entered the lake as larvae in the year the Brouwerssluice, which opens to the North Sea, was operative the whole year round. Due to high summer temperatures in the lake, juvenile plaice attained a mean length of 13.0 cm and a fresh weight of 27.4 g at the end of their first growing season. Total stock of plaice, excluding year class 1981, was estimated at an average of 1.3 million over 1980 and at 0.6 million fish over 1981. About 56% of the plaice food consisted of polychaetes, mainly consisting of in 1980 Arenicola marina (41%) and in 1981 A. marine (15%), Nereidae (15%) and Nephtys hombergii (11%). Total food consumption of the plaice population, excluding year class 1981, in 1980 and 1981 was estimated at 1.68 g and 1.41 g ash-free dry weight (ADW)/sq m/a. Annual consumption of O-group 1981 plaice was assessed at about 0.06 g ADW. The corresponding consumption of the flounder population was 1.14 g and 0.44 ADW, respectively. (Baker-IVI)
W86-01577

CARBON MINERALIZATION IN THE WATER OF LAKE GREVELINGEN (THE NETHERLANDS), AS MEASURED WITH THE OXYGEN CONSUMPTION METHOD,
Delta Inst. for Hydrobiological Researc
(Netherlands).
H. Goossens, R. S. Minnaar, and H. Ver
Netherlands Journal of Sea Research, V
3/4, p 480-491, December, 1984. 4 Fig,
Ref.

Descriptors: *Carbon, *Mineralization, *
velingen, *Netherlands, Lakes, Oxygen
tion, Oxygen levels, Solar radiation.

The carbon mineralization rate in the
Lake Grevelingen (Netherlands) was es
measuring the Oxygen Consumption R
of water samples from August 1980 u
1981. Carbon respiration amounted to
m/a. The water temperatures and the
bacteria were also measured. Rapid and
changes in the oxygen consumption rat
served. Regression analysis of OCR wi
environmental parameters showed a
high correlation of OCR with the sur
solar irradiance during 5 days preceding
sampling. Path analysis showed that th
of solar irradiance on OCR was not
temperature effect. The observed discr
tween the estimate for the amount of c
duced and mineralized in the water la
lake is discussed. (Baker-IVI)
W86-01578

**MINERALIZATION OF ORGANIC
ON AND IN THE SEDIMENT OF L
VELINGEN,**
Delta Inst. for Hydrobiological Researc
(Netherlands).
H. J. Lindeboom, H. A. J. De Klerk, an
Sandee.
Netherlands Journal of Sea Research, V
3/4, p 492-510, 1984. 4 Fig, 3 Tab, 43 Re

Descriptors: *Lake Grevelingen, *N
*Mineralization, *Organic carbon, *
ments, Saline lakes, Aquatic plants, A
mals, Biomass, Diffusion, Bioturbation,
oxygen, Temperature.

Sediments play an important role in the
activity in shallow aquatic environm
function as major sinks or sources of in
organic substrates for both primary pro
mineralization in the water column
sediment. A study was made of minera
and in the sediments as a part of a resea
on the carbon cycle in saline Lake G
(Netherlands). The oxygen uptake wa
using the bell jar method at 6 sampli
Applying a C over O2 conversion facto
was calculated that 330 g/sq m is mi
the sediment of the lake annually. Ba
mass estimates of the macroflora and f
the bell jars and a regression analysis, th
tion of these organisms to the carbon
tion rate was calculated to 70 and 95
respectively. The effect of oxygen gr
apparent diffusion coefficients upon
uptake rate was studied with microelect
indicated that bioturbation is a major f
encing the oxygen uptake rate. A good
was found between this rate and te
(Moore-IVI)
W86-01579

**CARBON BALANCE OF A SALI
(LAKE GREVELINGEN, THE
LANDS),**
Waterloopkundig Lab. te Delft (Netherl
I. De Vries.
Netherlands Journal of Sea Research, V
3/4, p 511-528, 1984. 1 Fig, 4 Tab, 35 Re

Descriptors: *Carbon balance, *Saline l
Grevelingen, *Netherlands, Lakes, Car
studies, Ecosystems, Phytoplankton, A
mals, Primary productivity, Food chain

Lake Grevelingen is a former estuary
erlands which was isolated by enclosin
the influences of the rivers Rhine and M
1964 and from the influence of the Nort

e connection with the North Sea was
established in 1978. An annual gross
lance is presented for Lake Greveingen.
c primary production is the main source
material, with an estimated contribution
60%. From a comparison of the carbon
ith oxygen consumption measurements,
ncy of the planktonic auto- and microhe-
c community in producing particulate
aterial is estimated at 44%. This is a high
pared to efficiencies of deeper coastal
he western English Channel and off the
ast (2.34%). The pelagic and benthic
nt of the lake are tightly coupled by the
tivity of benthic macrofauna, causing a
g pressure on phytoplankton (estimated
f net production) and a transport of
organic particles to the sediment by
of feces and pseudofeces, exceeding pas-
with a factor 3 to 4. In agreement with
n the western Wadden Sea, the role of
small foodweb in consuming primary
tter is probably limited. (Baker-IVI)

STRATEGIES OF INVERTE-
N DISTURBED AQUATIC HABI-

iv. (Ontario). Dept. of Zoology.
y.
the Minnesota Academy of Science,
3, p 28-30. 10 Ref.

*Invertebrates, *Benthos, *Aquatic
cology, Ecological effects, Drought,
vironment, Life cycles, Particulates,
tion effects.

ertebrates face two main types of dis-
their habitat: One is a change in the
ater surrounding them as in a flood or
other is a change in the physical or
ality of the water such as unusual or
roductions of particulate or dissolved
om the surrounding land. Aquatic in-
survive disturbance by moving to a
ernative habitat or by having resistant
protected stages in the life cycle. Some
are able to exploit the richer and
le food materials that may result from
Sometimes the potential for regenera-
lonization is so high that the loss of
counteracted by the influx of coloniz-
affected neighboring habitats. Most
sturbed aquatic habitats are efficient
hey combine one or more survival
th high powers of dispersal, rapid
and characteristics of ecological gen-
e ecological generalists may even be
xible in their life cycles and be able to
g at several times in the year. This
is not seen in all invertebrates in
ols where the life cycles in some
be precisely timed if the appropriate
ncide with drought. But even in these
eneralists can rapidly take advantage
ood or a late drought. Given these
s of efficient colonizers, it is not sur-
he earliest newcomers after disturb-
ic habitats are insects. Their great
spersal, regeneration, and tolerance
markably resilient in the face of any
ter, whether natural or deliberate.

G THE POPULATION DYNAMICS
ALMON (ONCORHYNCHUS KI-
NG POOLED TIME-SERIES AND
IONAL DATA,
Univ., Kingston. Dept. of Resource

, and J. E. Wilen.
nal of Fisheries and Aquatic Sci-
, No. 3, p 459-467, March, 1985. 6

Population dynamics, *Salmon, *Sta-
, *Washington, *Oregon, *Califor-
River, Fish management, Fish pop-
ations, Model studies.

The population dynamics of natural and hatchery coho salmon (Oncorhynchus kisutch) were estimated for three regions, (1) Washington coastal, (2) Columbia River region, and (3) Oregon/California coastal, using pooled time-series and cross-sectional data. Two functional forms were compacted: the Beverton-Holt and Ricker models. Both models yielded very similar results. In both cases, we found that the natural coho stock recruitment is significantly affected by parent stock level (positive), parent stock density (negative), river flow (positive), and hatchery smolt release (negative). The significant factors affecting hatchery coho salmon were smolt release level (positive), smolt release density (negative), and upwelling (positive). (Author's abstract)
W86-01585

WATER CIRCULATION IN SMALL ARCTIC LAKES IN WINTER,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
H. E. Welch, and M. A. Bergmann.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 506-520, March, 1985. 13 Fig, 12 Ref.

Descriptors: *Water circulation, *Arctic zone, *Lakes, *Winter, *Saqvaqjuac, *Northwest Territories, Mixing, Salinity, Stratification, Seasonal variation, Thermodynamics.

Dye experiments and detailed measurements of conductance and temperature in small lakes at Saqvaqjuac (63 degrees 39' N, 90 degrees 39' W, Northwest Territories) showed how water circulated in midwater. Stored heat returning from the sediments warms adjacent water, which then sinks downslope. Water immediately beneath the ice moves laterally shoreward, picking up cryoconcentrated salts and sinking downslope. Displacement of deep waters upward at the lake center is postulated as completing the circulation. Rates of water movement are on the order of 10 m/d in 2- to 10-ha lakes. This type of winter circulation is expected to be ubiquitous throughout the arctic. (Author's abstract)
W86-01586

WINTER RESPIRATION OF LAKES AT SAQVAQJUAC, N.W.T.,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
H. E. Welch, and M. A. Bergman.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 521-528, March, 1985. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Northwest Territories, *Saqvaqjuac, *Lakes, *Respiration, *Winter, Arctic zone, Plankton, Carbon radioisotopes, Methane, Water pollution effects.

Winter oxygen consumption rates at 64 degrees N latitude were measured for 11 lake years. They ranged from 0.131 to 0.306 g O2/sq m/d. They were not correlated with lake depth, in contrast with the winter respiration rates of temperate lakes. We suggest that this difference results from lower summer temperatures and a lower proportion of planktonic respiration in arctic as compared with temperate lakes. C-14 estimates of annual photosynthesis were generally lower than estimated annual respiration, and the C-14-measured photosynthesis beneath the ice in winter was generally too low to account for the actual amounts of oxygen evolved by photosynthesis. In one lake a 50% increase in annual production resulted in an increase of only 19% in winter respiration, suggesting that lake respiration is an integrative process that averages out production over a period of years. Addition of methane gas to simulate a gas pipeline break to a lake resulted in an immediate 67% increase in lake respiration rate. (Author's abstract)
W86-01587

WATER TEMPERATURE AS THE PRIMARY INFLUENCE ON TIMING OF SEAWARD MIGRATIONS OF ATLANTIC SALMON (SALMO SALAR) SMOLTS,
Direktoratet for Vilt og Ferskvannsfisk, Sandnes (Norway). Forskningsstasjion for Ferskvannsfisk.
B. Jonsson, and J. Ruud-Hansen.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 593-595, March, 1985. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Water temperature, *Salmon, *Fish migration, *Norway, *Imsa River, *Smolts, Lunar cycle, Water flow, Rivers, Migration, Animal behavior.

Using multiple regression models the correlation of water temperature, water flow, cloudiness, and lunar cycle with the timing of the yearly descent of Atlantic salmon (Salmo salar) smolts in the Norwegian Imsa River, 1976-83 was tested. Water temperature between 9 April and 16 May explained 91, 95, and 89% of the yearly variation in date of 25, 50, and 75% cumulative smolt descent, respectively. The regression models were not very sensitive to variations of which date recording of the temperature was started and stopped. The start of the yearly smolt run was not triggered by a specific water temperature or a specific number of degree-days, but was controlled by a combination of temperature increase and temperature level in the river during spring. There was no significant correlation between smolt descent and any of the other environmental variables tested. (Author's abstract)
W86-01589

METHOD FOR MEASURING HORIZONTAL TRANSPORT OF ORGANIC CARBON OVER SEDIMENTS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
J. Grant.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 595-602, March, 1985. 3 Fig, 24 Ref.

Descriptors: *Organic carbon, *Sediments, *Nutrient transport, Sand, Beaches, Benthos, Deposition.

Prewashed, precombusted sand from a sheltered beach in Nova Scotia was returned to the beach at low tide in metal pans. Hourly sampling of pans during high tide was used to assess gross deposition of organic carbon to the bed, with sampling at successive low tides to derive net deposition rate. Resuspension was considered to be the difference between gross and net deposition. Short-term burial of carbon was measured by vertically sectioning pan samples. The results indicate that due to resuspension, the rate of net deposition over 2d (11 g C/sq m/h) was only 42% of the rate of gross deposition that occurred during a single high tide. The method is useful because it can resolve the short-term particle fluxes that may be trophically important to benthic communities. (Author's abstract)
W86-01590

RESULTS OF OHIO RIVER MACROINVERTEBRATE SAMPLING FOR 1975-1981,
West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources.
For primary bibliographic entry see Field 5C.
W86-01591

SURVEY OF THE FRESHWATER MUSSEL FAUNA OF THE KANAWHA RIVER SEPTEMBER 1981-SEPTEMBER 1982,
West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources.
J. E. Schmidt, and M. A. Zeto.
Proceedings of the West Virginia Academy of Sciences, Vol. 55, No. 2/3/4, p 72-75, 1983. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Mussels, *Kanawha River, *West Virginia, Species composition, Aquatic population, Rivers, Benthos.

Freshwater mussels (naiads) were collected from the Kanawha River, West Virginia, at several locations between Winfield and Falls View as part of a statewide survey to identify naiad populations.

Sampling took place during the Fall of 1981 and the Fall of 1982 when the river was low and clear. Naiad populations were sampled with a 10-foot dovetail mussel brail and sight/hand collecting. Nineteen species of naiads and the asiatic clam Corbicula sp. were collected. The majority (18 species) were collected in the seven-mile stretch of the Kanawha River downstream of Kanawha Falls. Two species - Cyprogenia stegaria and Obliquaria reflexa are very rare in West Virginia. Only Corbicula sp. and one naiad species, Anodonta g. grandis, were collected downstream of Charleston. No endangered species were collected, although a population of Lampsilis abrupta (= orbiculata) is known to occur downstream of Kanawha Falls near Deepwater. (Author's abstract)
W86-01592

AQUATIC VEGETATION OF A NATURAL MARL LAKE IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Anatomy.
R. Bartgis.
Proceedings of the West Virginia Academy of Science, Vol. 55, No. 2/3/4, p 92-101, 1983. 2 Fig, 2 Tab, 24 Ref.

Descriptors: *Aquatic vegetation, *Marl lakes, *West Virginia, *Lake Louise, *Jefferson County, Mosses, Pondweed, Elodea, Duckweed, Species composition.

Lake Louise is a 14.5 m deep natural marl lake in Jefferson County, West Virginia. The aquatic vegetation of the lake occurs primarily in four concentric zones associated with increasing water depth. Each zone is characterized by a distinct plant community. In July 1982 the percent cover of each vascular and bryophytic species was recorded for each community. Dominant macrophytic species in these communities included the emergents Sparganium eurycarpum, and Nasturtium officinale and Veronica anagallis-aquatica in the two shallowest zones, respectively; Potamogeton spp. in an intermediate zone; and Elodea canadensis in the deepest zone. In addition, a fifth separate community dominated by Potamogeton crispus has developed in a small cove of the Lake. Within a community, vertical stratification also occurred. For example, the floating thalloid Lemna minor often formed a prominent surface layer. The flora of Lake Louise is similar to that of marl lakes in the glaciated northeastern United States. Community structure, such as species richness and number of dominants, was generally less complex at Lake Louise than in the northern lakes. (Author's abstract)
W86-01594

LIFE HISTORY AND ECOLOGY OF THE ALDERFLY, SIALIS AEQUALIS BANKS, FROM FLATFOOT CREEK, MASON COUNTY, WEST VIRGINIA,
West Virginia Dept. of Natural Resources, Charleston.
R. W. Gatewod, and D. C. Tarter.
Proceedings of the West Virginia Academy of Science, Vol. 55, No. 2/3/4, p 102-113, 1983. 3 Fig, 3 Tab, 18 Ref.

Descriptors: *Flatfoot Creek, *Mason County, *West Virginia, *Alderflies, *Ecology, Hydrogen ion concentration, Water quality, Larvae, Growth stages.

The alderfly Sialis aequalis Banks, from Flatfoot Creek, Mason County, West Virginia, was studied relative to its life history and ecology between April 1978 and May 1979, and its low pH tolerance experimentally estimated in the laboratory. Larvae were collected along the stream margins from a substrate of vegetative debris, mud, and silt. Larvae were detritivorous in their feeding habits, despite the high food potential of their habitat. Their diet was infrequently supplemented with chironomids and other dipterans. Length frequency distributions for larvae indicated one size class for the population, and thus a univoltine life cycle. Growth rate, based upon mean head capsule width, was optimal during the first month of the larval stage (May-June). No increase in head capsule width was observed in February and March, the final months of the larval stage. Pupation in the laboratory was variable in duration, ranging from 10 to 22 days. In the field, pupation began in late March and concluded 4 to 5 weeks later. Adults were first observed in late April, and none were sighted after May 10. Ovarian eggs of adult females ranged in number from 402 to 818, -x = 657. Mean egg length and width were 0.23 and 0.61 mm, respectively. The 96-hour median tolerance limit for low pH for S. aequalis larvae was 2.3. W86-01595

RESERVOIR FISHERY RESEARCH NEEDS AND PRIORITIES,
Tennessee Valley Authority, Chattanooga.
For primary bibliographic entry see Field 8I.
W86-01598

ASSESSING HABITATS USED BY WARMWATER STREAM FISHES,
Illinois Natural History Survey, Champaign.
R. W. Larimore, and D. D. Garrels.
Fisheries, Vol. 10, No. 2, p 10-16, March/April, 1985. 8 Fig, 2 Tab, 10 Ref.

Descriptors: *Aquatic habitats, *Fish populations, *Streams, Habitats, Monitoring, Radiotelemetry, Animal behavior, Ecology, Fish behavior.

Five methods were developed for locating and identifying an undisturbed, free-swimming, stream fish. These methods used (1) color-coded tags, (2) fixed electrodes, (3) optical measurements, (4) night collections, and (5) radiotelemetry. They permitted observations of most kinds of fishes, at any time of day or night, during any season (including under ice), and from streams of different sizes. Although no one method was equally useful in all situations, the methods were evaluated according to their effectiveness in determining habitat preferences of different fish species under various stream conditions. The importance of precision in locating a fish and its habitat was emphasized by the finding of significant differences in physical measurements over extremely small areas. (Author's abstract)
W86-01599

MANAGEMENT OF LACUSTRINE FISHERIES IN THE TROPICS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 8I.
W86-01600

EFFECT OF TEMPERATURE ON THE GROWTH OF PLANKTONIC LARVAE OF TELLINA TENUIS DA COSTA,
Dunstaffnage Marine Research Lab., Oban (Scotland).
For primary bibliographic entry see Field 5C.
W86-01603

CALCIUM CHEMISTRY AND DEPOSITION IN IONICALLY ENRICHED ONONDAGA LAKE, NEW YORK,
Upstate Freshwater Inst., Inc., Syracuse, NY.
For primary bibliographic entry see Field 5B.
W86-01618

GROWTH OF SUBMERSED MACROPHYTE COMMUNITIES IN THE ST. CLAIR - DETROIT RIVER SYSTEM BETWEEN LAKE HURON AND LAKE ERIE,
Fish and Wildlife Service, Ann Arbor, MI. Great Lakes Fishery Lab.
D. W. Schloesser, T. A. Edsall, and B. A. Manny.
Canadian Journal of Botany, Vol. 63, No. 6, p 1061-1065, June, 1985. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Macrophytes, *Plant growth, *Aquatic plants, *St. Clair River, *Detroit River, Submerged plants, Biomass, Seasonal variation, Rivers, Overwintering, Dominance, Succession, Great Lakes.

Growth of submersed aquatic macrophytes was determined from observation and on the basis of biomass of samples collected from Ap
vember 1978 at seven study sites in a m
system of the Great Lakes, the St. Clai
river system between Lake Huron and
Growth usually began between April
peaked between July and October, and
by late November. Maximum biomass a
seven sites (118-427 g dry weight/sq m)
lar or greater than that reported in othe
similar latitudes. Seasonal growth of the
taxa followed one of three seasonal
each study site: one dominant taxon g
codominant taxa grew sympatrically wi
cies succession; and codominant taxa gr
trically with species succession. Diffe
growth and seasonal succession of some
apparently caused by the presence of
overwintering plant material, competitio
cycle differences. (Author's abstract)
W86-01629

SIMPLE METHOD TO ESTIMAT PHOSPHORUS CONCENTRATIONS ING FROM NATURAL, BACK LOADINGS,
Pavia Univ. (Italy). Ist. di Entomologi
M. Vighi, and G. Chiaudani.
Water Research, Vol. 19, No. 8, p 987-9
Fig, 1 Tab, 22 Ref.

Descriptors: *Phosphorus, *Lakes, *M
phic index, Water depth, Alkalinity, Co
Water quality control, Lake restoration
ication, Trophic levels.

The relation of mean total phosphorus
tions to morphoedaphic index (calcula
ratio between the mean depth and alkali
conductivity) has been examined for
verse, widely distributed group of lakes
significant correlation was found in lake
ly not affected by anthropogenic input o
rus. As a consequence the phosphorus
tion in a lake resulting from natural, b
loading could be calculated on the b
morphoedaphic index. The evaluation
phosphorus concentration allows the pr
the maximum extent to which actual
concentrations could be reduced in cu
trophied lakes by eliminating the ant
inputs and to calculate 'permissible' load
sary to achieve natural trophic conditio
not necessarily correspond to oligotr
thor's abstract)
W86-01640

DIAGENETIC REMOBILIZATION GANESE, IRON, COPPER AND ANOXIC SEDIMENT OF A FRES POND,
Central Research Inst. of Electric Powe
Tokyo (Japan).
M. Sakata.
Water Research, Vol. 19, No. 8, p 1033-
3 Fig, 27 Ref.

Descriptors: *Manganese, *Iron, *Cop
*Sediments, Ponds, Reservoirs, Interst
Anoxic conditions, Remobilization, Fat
ants, Heavy metals.

The diagenetic remobilization of mang
copper and lead in anoxic sediment of a
pond, T Reservoir, Japan has been exa
in situ submerged chamber system, thr
stitial water and sediment analyses. Man
released continuously from the sedime
overlying water during the experimen
iron was released from the sediment ab
the 2nd day of the experiment. Steep v
centration gradients of manganese and
observed in the interstitial water. The
manganese and iron from the sediment i
dissolution of ferro-manganese oxides a
ides in the surface sediment under an
tion. In contrast to manganese and ir
and lead were not released from th
during the experiment, and their conce
the interstitial water were not significa
ent from the values of the overlying

show that the diagenetic remobilization of and lead in the sediment is negligibly small. ely that copper and lead are fixed into the t by some process other than the formation es. (Author's abstract)
646

IEMICAL MASS BALANCE OF A VOL-CRATER LAKE IN AUSTRALIA,
Univ. of South Australia, Bedford Park. f Earth Sciences.
amamurthy, H. H. Veeh, and J. W.

f Hydrology, Vol. 79, No. 1/2, p 127-139, 5. 5 Fig, 6 Tab, 12 Ref.

ors: *Blue Lake, *South Australia, *Crater Chemical composition, *Geochemistry, vater, Uranium, Calcium, Sodium, Chlor-rates, Water quality control, Conjunctive s.

e in the southeast of South Australia is the a group of four volcanic crater lakes in ns. It has a surface area of approximately q m, an average depth of 70 m, and is the rce of reticulated water supply to a city pulation of about 20,000 inhabitants. Ni-centrations have been rising steadily over The recharge regime of Blue Lake was d by using the environmental tracers U artly precipitated in the sediments) and 1 (conserved in the lake's waters). The cal mass balances allowed best estimates ater budget to be derived. These are: e from groundwater of 5,000,000 cu m/ flow rate into the groundwater is there-1,000,000 cu m/yr, because the meas-ing rate is 4,000,000 cu m/yr. The un-Gambier limestone aquifer contributes e inflow and receives 100% of the out-lower-lying aquifer (Dilwyn Formation ediments) contributes 15% to the inflow. nconfined aquifer is the main source of o the lake, the problem of increasing centrations of the lake water could be d by initiating conservation measures to ther pollution of the water table aquifer. ed aquifer in the region could be ex-ther to supplement the drinking water ts of the region, since the composition e itself would not be adversely affected uence. (Moore-IVI)

FOR LOCATING SEDIMENT ES IN LAKEBEDS THAT CAN BE Y GROUNDWATER FLOW,
ergy of Canada Ltd., Chalk River (On-k River Nuclear Labs.

Hydrology, Vol. 79. No. 1/2, p 187-193, 3 Fig, 13 Ref.

: *Groundwater movement, *Measur-ents, *Lake beds, Temperature, Con-eepage, Lake sediments, Groundwater

discharges of groundwater should be d not only by anomalous temperature but also by water interface of lakes. inflows by detecting such anomalies ctive where groundwater inflow areas red from other geologic or hydraulic such as areas of lakes that lie over ault zones. A device was designed to long lakebeds for locating such anom-ment temperature or chemistry. The ensity balanced probe containing tem-sducers and an electrical conductivity g was used successfully to detect an reated seepage area in soft bottom ow 8 m of lake water. The drag has d for in-situ, continuous, horizontal ne absolute temperature of sediment, ure difference between sediment and ter, and the electrical conductivity of ker-IVI)

ESTIMATING ALGAL AVAILABLE PHOSPHORUS IN SUSPENDED SEDIMENTS BY CHEMICAL EXTRACTION,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 5A.
W86-01714

SIMULTANEOUS IN-STREAM NITROGEN AND D.O. BALANCING,
Texas Univ. at Dallas, Richardson. Callier Center for Communication Disorders.
J. J. Warwick, and A. J. McDonnell.
Journal of Environmental Engineering, Vol. 111, No. 4, p 401-416, August, 1985. 3 Fig, 4 Tab, 39 Ref.

Descriptors: *Nitrogen, *Dissolved oxygen, *Water analysis, *Model studies, Nutrients, Water quality, Ammonia, Nitrates, Nitrites.

A one-dimensional, pseudo unsteady state, water quality model (Simultaneous Nitrogen and Oxygen Analysis Program - SNOAP) was developed to simultaneously solve both nitrogen and dissolved oxygen mass balance equations. Expressions are derived to estimate ammonia-N exsolution, bacterial ammonia-N uptake, and aquatic plant ammonia-N assimilation in terms of standard water quality indices. The SNOAP model calculates hourly values for all nitrogen species reaction rates (including nitrification and denitrification) based on observed in-stream variation of organic-N, ammonia-N, nitrite-N, nitrate-N, dissolved oxygen, temperature, and pH. An iterative solution algorithm is required to simultaneously solve the nitrogen and dissolved oxygen mass balance equations. This iterative approach is stable and results in relatively quick convergence. Erroneous values of observed nitrogen species or dissolved oxygen variation, or both, may result in an impossible situation for simultaneous nitrogen and dissolved oxygen mass balance solution. This nonconvergence feature is a significant attribute, in that is allows for a systematic screening of measured water quality data. (Author's abstract)
W86-01722

NITROGEN ACCOUNTABILITY FOR FERTILE STREAMS,
Texas Univ. at Dallas, Richardson. Callier Center for Communication Disorders.
J. J. Warwick, and A. J. McDonnell.
Journal of Environmental Engineering, Vol. 111, No. 4, p 417-430, August, 1985. 6 Fig, 7 Tab, 12 Ref.

Descriptors: *Nitrogen, *Streams, *Dissolved oxygen, *Water quality, *Model studies, Denitrification, Ammonia, Water pollution effects, Wastewater.

The Stream Nitrogen and Oxygen Analysis Program (SNOAP) is a one-dimensional, pseudo unsteady state, water quality model, which simultaneously solves both nitrogen and dissolved oxygen mass balance equations. The SNOAP model was successfully calibrated and verified for three, independent, data intensive water quality surveys. The modeled stream system was unsteady due to significant upstream impact from wastewater treatment plant effluent discharges. Denitrification was found to be the dominant total nitrogen sink. Average denitrification rates calculated by the SNOAP model range from 22.0-43.6 mg-N/sq m/hr. The computed values compared quite favorably with measured laboratory sediment denitrification rates which ranged from 28.2-39.2 mg-N/sq m/hr. In addition, the rate of ammonia-N decay was found to be the most accurate nitrogen species estimator of in-stream nitrification rates. (Author's abstract)
W86-01723

ATTENUATION VERSUS TRANSPARENCY,
Upstate Freshwater Inst., Inc., Syracuse, NY.
For primary bibliographic entry see Field 5A.
W86-01725

SUMMER SOIL MOISTURE CONTENT AND THE WATER TABLE IN A FORESTED WETLAND PEAT,
Toronto Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2G.
W86-01779

TRITIUM IN NATURAL WATERS OF MOLDAVIA AND A HYDROGEOLOGICAL INTERPRETATION OF THE RESULTS OF ITS DETERMINATION,
Akademiya Nauk Moldavskoi SSR, Kishinev. Inst. of Geophysics and Geology.
I. V. Zelenin, I. E. Verbitskii, I. K. Morkovkina, and V. V. Romanov.
Water Resources, Vol. 11, No. 1, p 324-334, July-August, 1984. 3 Fig, 4 Tab, 17 Ref. Translated from Vodnye Resursy, No. 4, p 70-81, July-August, 1984.

Descriptors: *Tritium, *Natural waters, *Moldavia, *Dnestr River, *Prut River, *USSR, River water, Precipitation, Groundwater, Water analysis, Groundwater movement, Aquifers.

The main hydrographic elements of Moldavia (USSR) are the Dnestr and Prut rivers. They originate in the Carpathians and have mean annual discharges respectively of 293 and 74 cu m/sec. The main aquifer complex is represented mainly by limestones of Baden-Sarmatina age. Its thickness reaches 100-150 m. The character of groundwater movement is quite complex due to the variability of the conditions of their recharge and discharge, inhomogeneity of the seepage properties of the rocks, intense water withdrawal from wells, and also by the absence in the geological section of thick, persistant impervious horizons which could serve as regional aquicludes. The groundwaters in the cover deposits of divides are partially directed toward the thalwegs of the erosional incisions, where they merge with the waters of the floodplain alluvium, and partially percolate into lower lying aquifers. In 1978-80 the tritium concentrations in river waters varied mainly from 40 to 90 TU. Neither regional nor temporal trends were noted in this case. The observed variations, in particular, are related to the nonuniformity of tritium concentrations in precipitation. Especially noticeable is the relation between tritium concentrations in river water and precipitation for the Dnestr River, where the effect of regulation of surface runoff is apparently not felt so strongly as in small rivers. In the overwhelming majority of cases the tritium concentrations in rivers are less than in precipitation, by about 30% on average in small rivers. This indicates a considerable role of the groundwater component in feeding rivers and agrees well with the hydrological estimate of the portion of groundwaters (23-27%) in the river runoff of the Dnestr-Prut interfluve. (Baker-IVI)
W86-01806

INVESTIGATION OF CO2 GAS EXCHANGE IN A CONVECTIVELY MIXED LAYER,
Moscow State Univ. (USSR).
A. O. Kokorin.
Water Resources, Vol. 11, No. 4, p 343-347, July-August, 1984. 1 Fig, 11 Ref. Translated from Vodnye Resursy, No. 4, p 90-94, July-August, 1984.

Descriptors: *Carbon dioxide, *Convection, *Gas exchange, Temperature effects, Stratification, Model studies, Oxygen transport, Mixing.

The conditions of fall-winter cooling accompanied by convective mixing of the upper layer of the water body and gradual deepening of the boundary of the convectively mixed layer are examined. The experimental profiles obtained made it possible to calculate the flow of carbon dioxide from water into the air and the average gas exchange rate k. The flow and gas exchange rate were calculated for 10 experimental series, each of which consisted of a period of heating of the basin from above (2-4 days) and period of cooling accompanied by convective mixing (6-9 hr). The CO2 distribution with respect to depth is determined by processes of diffusion and gas exchange across the interface and also by the chemical equilibrium between various carbonate forms. The concentration gradients of various carbonate forms are not equal among

themselves and therefore independent diffusion can lead to a redistribution of the total concentration of inorganic carbon between carbonate forms. A model is proposed which proved able to satisfactorily describe the experimental data. The formula used in the model for calculating the exchange coefficient during convective mixing gave values of the coefficient close to those found in natural water bodies, and it is assumed that the given calculation scheme will work satisfactorily also in the case of gas transport during fall-winter cooling of the ocean. In a simplified form the model was tested for calculation of oxygen transport. (Baker-IVI)
W86-01808

PHOSPHORUS FORMS AND CONTENT IN NATURAL WATER AND FACTORS DETERMINING ITS CYCLING,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2K.
W86-01811

HYDROLOGICAL AND HYDROCHEMICAL ASPECTS OF THE TRANSFORMATION OF ORGANIC MATTER IN THE MOZHAISK RESERVOIR,
Moscow State Univ. (USSR).
L. B. Berdavtseva, and G. V. Tsytsarin.
Water Resources, Vol. 11, No. 4, p 370-377, July-August, 1984. 4 Fig, 3 Tab, 12 Ref. Translated from Vodnye Resursy, No. 4, p 121-129, July-August, 1984.

Descriptors: *Organic matter, *Mozhaisk Reservoir, *Hydrology, Chemical analysis, Phosphorus, Dissolved oxygen.

An analysis of the transformation of organic matter in the Mozhaisk reservoir on the basis of the indices of color, permanganate oxidizability (PO), and dichromate oxidizability (DO) in the annual cycle showed the main cause of the most considerable changes in the relationship between the investigated indices is occurrence of labile organic matter (LOM) related to intensification of production-destruction processes. All changes in the relationships between the investigated indices occur synchronously. The character of the relation between color, PO and DO changes practically simultaneously in response to an increase of the amount of LOM in the reservoir, which makes it possible to estimate the direction of processes forming the water quality at each given moment on the basis of one of the relationships or both simultaneously. Two extreme types of dependence, expressed by the equation of linear regression between the investigated indices, which conditionally characterize the maximum degree of transformation and maximum degree of instability of OM were distinguished. (Baker-IVI)
W86-01812

SPACE-TIME INHOMOGENEITY OF DISTRIBUTION OF ORGANIC MATTER IN THE MOZHAISK RESERVOIR,
Moscow State Univ. (USSR).
M. G. Ershova, M. B. Zaslavskaya, and N. M. Zyablova.
Water Resources, Vol. 11, No. 4, p 378-385, July-August, 1984. 4 Fig, 7 Tab, 12 Ref. Translated from Vodnye Resursy, No. 4, p 130-138, July-August, 1984.

Descriptors: *Mozhaisk Reservoir, *USSR, *Organic matter, Reservoirs, Chemical composition, Seasonal variation, Temporal distribution.

Within an accuracy of 25%, the study showed the effect of production-destruction processes on the average organic matter concentrations in individual sufficiently large stretches and in the entire volume of the Mozhaisk reservoir (USSR) is insignificant and it can be neglected in such calculations. It is possible that this conclusion is applicable also to other more eutrophic reservoirs of the forest zone with seasonal streamflow regulation. The characteristic weather changes for this zone during the growing season result in the times of dominance of the production of organic matter are replaced by times of dominance of destruction of autochthonous organic matter and on the whole the average concentration of organic matter is to a considerable extent determined by the amount of allochthonous matter introduced from the drainage basin. (Baker-IVI)
W86-01813

FORMATION OF THE HYDROBIOLOGICAL AND HYDROCHEMICAL REGIME OF THE NORTHERN DONETS-DONBAS CANAL (1958-1981),
Central Water Monitoring, Research, Planning, and Surveying Lab. (USSR).
A. I. Kovrizhnykh.
Water Resources, Vol. 11, No. 4, p 391-396, July-August, 1984. 2 Ref. Translated from Vodnye Resurnye, No. 4, p 144-150, July-August, 1984.

Descriptors: *Northern Donets-Donbas Canal, *USSR, *Bottom sediments, Canals, Erosion, Siltation, Phytoplankton, Velocity, Transparency, Bottom sediments.

The Northern Donets-Donbas Canal (USSR) has been operating for more than 20 years. During this period, the main characteristics of the hydrobiological and hydrochemical regimes of the canal at different stages of its operation have been established. Substantial changes were noted in the hydrobiological regime of the canal. Impoverishment of the species composition of phytoplankton occurred due to the elimination of green algae and the abundance of blue-greens decreased. In the phytobenthos the quantity of green filmentous algae decreased considerably and the mass development of Vaucheria and appearance of Thorea occurred. The abundance of submersed higher aquatic plants decreased and a tendency toward an expansion of the areas occupied by amphiphytes was noted. Among the main interdependent factors that caused these changes are an increase of flow velocities, decrease of water transparency, siltation, and erosion and redistribution of bottom sediments in the canal. (Baker-IVI)
W86-01815

CHARACTERISTICS OF FISH HELMINTH FAUNA IN SOME WATER BODIES OF THE NORTH DVINA BASIN UNDER CONDITIONS OF AN ALTERED WATER REGIME,
Gosudarstvennyi Nauchno-Issledovatel'skii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad (USSR).
E. A. Bogdanova, and L. I. Kotova.
Water Resources, Vol. 11, No. 4, p 396-401, July-August, 1984. 1 Tab, 29 Ref. Translated from Vodnye Resursy, No. 4, July-August, 1984.

Descriptors: *Dvina Basin, *USSR, *Biomass, *Helminths, *Fish parasites, Runoff, Seasonal variations, Shallow water, Lake Kubenskoe, Lake Lacha, Lake Vozhe, Parasites, Hydrological regime.

The region of Lakes Kubenskoe, Lacha, and Vozhe belongs to the excess moisture zone of the European sector of the USSR. Lake Kubenskoe is a large shallow water body with an area of 400 sq km, average depth of 2.5 m, and maximum depth of 4.5 m. The variation of individual elements of the climate is governed by the effect of certain types of atmospheric circulation. The annual distribution of the runoff of the rivers, creeks, and brooks emptying into Lake Kubenskoe mainly determines its level regime. All three lakes are intensely overgrown by macrophytes. In the winter the dissolved oxygen content in the water does not exceed 32% of saturation. During inflow of Sukhona waters into Lake Kubensoe an overall increase of biogenic substances in it is possible. Many fish parasites have favorable ecological conditions in the lake for development. Some reservoirs constructed on rivers possess their own hydrobiocenose, including invertebrates and fishes. Beds of macrophytes with an invertebrate fauna characteristic for them will appear in the littoral, well-heated stretches with a weak current. With time they will become the nesting sites of fish-eating birds, which will lead to increased infestation of fishes by cestodes and trematodes. The available ichthyoparasitologic data sho number of helminths having epizootol epidemiological significance are found fishes of Lake Kubenskoe and the Sukh (Baker-IVI)
W86-01816

INVESTIGATIONS OF THE ECOL PLANKTONIC ALGAE OF WATER B THE BAIKAL REGION,
Irkutskii Gosudarstvennyi Univ. (USSR cal and Geographical Research Inst.
O. M. Kozhova, and V. N. Pautova.
Water Resources, Vol. 11, No. 3, p 244 June, 1984. 2 Fig, 1 Tab, 20 Ref. Trans Vodnye Resursy, No. 3, p 114-124, 1984.

Descriptors: *Algal growth, *Seasonal *Phytoplankton, *Lake Baikal, *Angara *USSR, Ice cover, Spatial distribution Reservoirs, Lakes.

The characteristics of the ecology of established during the analysis of thei dynamics. Seasonality in the developm toplankton of Lake Baikal and the An voirs is clearly expressed as a replac cryophilic complex of algae developing covered period by a more thermophil complex. Such a succession of species is all water bodies of temperate latitudes. ality in the develoment of phytop Angara reservoirs is expressed differen Baikal. In Bratsk reservoir an under ic development of algae is observed eve Baikal, productive years for under ice ton, when the biomass reaches 30 g more, recur with a period of 2-4 years. ductive years the under ice biomass of ton of Baikal does not exceed 0.1 g/c Bratsk reservoir in connection with the of under ice development of phytoplan is recorded only from the second ha before breakup of the reservoir, the biomass is created in open water, Baikal, life in the lake depends on the a in the ice-covered period in a producti only in that year but in subsequent year reservoir the same species form the und mum biomass of phytoplankton from y In Baikal there are far more species u Similar studies were conducted regard tial distribution of the algae as well.
W86-01824

MICROBIOLOGICAL CHARACTER WATER MASSES IN THE MOUTH OF LARGE RIVERS FLOWING INT ERN BAIKAL,
Irkutskii Gosudarstvennyi Univ. (USS cal and Geographical Research Inst.
V. N. Maksimov, E. A. Maksimova, an Rudykh.
Water Resources, Vol. 11, No. 3, p 25 June, 1984. 3 Fig, 9 Ref. Translated fr Resursy, No. 3, p 125-130, May-June, 1

Descriptors: *Rivers, *Lake Baik *Microbiology, Vertical distributio River mouth.

The mouth regions of large rivers Baikal based on microbiological indice plex system of mixing of two water and lake. Their inhomogeneity is clear the basis of the vertical dynamics of th values and abundance of saprophytic b water of northern Baikal, and especia mouth regions, is distinguished by inc by an order of magnitude) indices of cal activity compared with waters of southern Baikal. The microbiologica waters of the Tompa River and its should be considered natural (backgr at present, the river is not experie anthropogenic influences. The low production is found in waters of the and Rel' rivers (1.33 and 0.79 mic

As a consequence of this their potential ca-
for self-purification is quite low. Microorga-
capable of growing on media with hydrocar-
re constant components of microbiocenoses
water column of northern Baikal. (Baker-

1825

**E ZONE MAPPING AND CLASSIFICA-
OF A NORTHERN LAKE,**
tate Univ., Columbus. Dept. of Geology
neralogy.
fcKenzie, and D. I. McKenzie.
nd Beach, Vol. 52, No. 4, p 9-14, October,
Fig, 2 Tab, 15 Ref.

tors: *Lakes, *Lake shores, *Mapping,
o, *Kesagami Lake, Beaches, Classification,
, Peat, Shores.

iptive shore zone classification, consisting
classes was developed to understand the
of Kesagami Wilderness Park, a new wil-
park in Ontario, during an earth science
nt of the region. The shore map depicts
s of shores in a descriptive classification
ides useful information for planners, man-
ke users and exploration geologists. The
usual features of the shores of Kesagami
the peat bluffs up to 4 m in height. They
en recognized for almost a century and
xceptional for Ontario. They provide an
ive and scientific resource in that they
subsurface dimension of a landscape that
on for much of northern Ontario. Prob-
most important information shown on the
ne map of Kesagami lake is the number
ion of the sand beaches which historically
n the landing and camping sites. The sand
re themselves unusual in that many over-
nd may be as thin as 10 cm. The shores of
ake (Missinaibi Lake) have been mapped
fied in like fashion for similar purposes. It
d that these techniques can be applied in a
nner in lakes throughout the glaciated
Baker-IVI)
9

**AL COMPOSITION OF TRANSKEI
VATER,**
Vestville Univ. (South Africa). Dept. of
.
ez.
A., Vol. 11, No. 1, p 41- 47, January,
g, 4 Tab, 10 Ref.

rs: *Transkei, *South Africa, *Chemical
on, *Rivers, Water quality, Molybde-
nic, Mercury, Water pollution sources,
as, Silt.

quality of the rivers flowing through
was determined over a period of two
fford a general picture of the chemical
n of Transkei river water. The period of
cided with a relatively dry period in
nd Southern Africa) and all results will
evaluated within this context. The more
findings resulting from the study are:
iver water generally contains very few
constituents; the south-western parts of
xhibit higher concentrations of analytes
to north-eastern Transkei; pollution
nskei is limited to Butterworth (urban
ion; macro elements plus molybdenum)
mber of other sites where very high
centrations are attributed to the leach-
cattle dip material into rivers; pollution
blic of South Africa adjoining Transkei
stown (urban contamination; macro ele-
in the Elliot-Ugie-Maclear region (mer-
silt loads in terms of unit areas of
are lower than presently accepted
thor's abstract)

**NUM AVAILABILITY, NITROGEN
ON, AND PHYTOPLANKTON
N NATURAL WATERS,**
v., Ithaca, NY. Section of Ecology and
Systematics.
R. W. Howarth, and J. J. Cole.
Science, Vol. 229, No. 4714, p 653-655, August, 1985. 1 Fig, 1 Tab, 38 Ref. NSF grants BSR-83-05176 and INT-83-04275.

Descriptors: *Limiting nutrients, *Molybdenum, *Phytoplankton, *Nitrogen, Marine environments, Coastal waters, Lakes, Algal growth, Sulfates, Phosphorus, Nitrogen fixation, Nitrates.

In most lakes, the supply of phosphorus controls primary productivity, yet phytoplankton productivity in most estuaries and coastal seas is controlled by nitrogen supply. Rates of nitrogen fixation may be low in coastal waters because molybdenum availability is low. In a series of experiments examining the uptake of radioactive Mo-99 by phytoplankton, environmentally realistic concentrations of sulfate inhibit molybdate assimilation. Sulfate inhibition of molybdate assimilation by phytoplankton makes molybdate less available in seawater than it is in freshwater. As a result, nitrogen fixation and nitrate assimilation, both processes that require molybdenum, may require a greater expenditure of energy in seawater than in freshwater. Experimentally increasing the ratio of sulfate to molybdate inhibits molybdate uptake, slows nitrogen fixation rates, and slows the growth of organisms that use nitrate as their nitrogen source. (Moore-IVI)
W86-01863

STUDY OF THE DISTRIBUTION OF FRESHWATER MUSSELS (MOLLUSCA: PELECYPODA: UNIONOIDA) OF THE LAKE CHAMPLAIN DRAINAGE IN NORTHWESTERN NEW ENGLAND,
Massachusetts Univ., Amherst. Museum of Zoology.
D. G. Smith.
American Midland Naturalist, Vol. 114, No. 1, p 19-29, July, 1985. 3 Fig, 3 Tab, 29 Ref.

Descriptors: *Lake Champlain, *Mussels, *Distribution, Fall line, Migration, Species composition, History.

Lake Champlain occupies a large shallow basin in northeastern North America and drains to the St. Lawrence River. The freshwater mussel fauna of the lake's drainage system includes both Northern Atlantic and Interior Basin species. An analysis of the distribution of the mussel species in the eastern and southern drainage streams of Lake Champlain reveals that fall lines have controlled upstream migration at various stages during the lake's postglacial history. Species composition differs above and below fall lines within drainage streams and varies geographically between drainage streams. Such distribution patterns may be explained by proposed periodic invasions of Lake Champlain by species during specific postglacial lake stages. (Author's abstract)
W86-01877

EFFECTS ON THE FOREST FLOOR OF WHOLE-TREE HARVESTING IN AN APPALACHIAN OAK FOREST,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Forestry.
J. E. Johnson, D. W. Smith, and J. A. Burger.
American Midland Naturalist, Vol. 114, No. 1, p 51-61, July, 1985. 2 Fig, 4 Tab, 40 Ref.

Descriptors: *Whole-tree harvesting, *Logging, *Oak trees, *Nutrients, Forest management, Soil solution, Clear-cutting, Soil temperature, Ammonia, Nitrates, Potassium, Soil water, Cycling nutrients.

The size of the forest floor nutrient pool and degree of mineralization from this pool (as measured by nutrient concentrations in the soil solution) were compared between a clear-cut and an adjacent forested site. Forest floor dry weights and nutrient contents were monitored for 28 months following the whole-tree harvest. Soil solution nutrient concentrations, temperature at a depth of 2.5 cm, and percent moisture in the top 10 cm of mineral soil were also monitored following cutting. Immediately following cutting, the forest floor was significantly heavier in the cut area due to logging residue, but after 28 months the clear-cut area forest floor had a dry weight of 10,500 kg/ha compared to 15,400 kg/ha in the uncut area. Following cutting, concentrations of NH4(+)-N, NO3(-)-N and K were higher in the soil solution of the cut area, whereas concentrations of P, Ca and Mg were similar in both areas. The higher concentrations in the clear-cut were attributed to more rapid decay of logging slash and forest floor material and reduced vegetative uptake. (Author's abstract)
W86-01878

POPULATION AND REPRODUCTIVE DYNAMICS OF NAIS COMMUNIS (OLIGOCHAETA: NAIDIDAE) FROM A WISCONSIN LIMNOCRENE,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
M. E. Smith.
American Midland Naturalist, Vol. 114, No. 1, p 152-158, July, 1985. 2 Fig, 1 Tab, 24 Ref.

Descriptors: *Limnocrenes, *Oligochaetes, *Population dynamics, *Reproduction, Wisconsin, Springs, Paratomy, Water temperature, Alkalinity, Hydrogen ion concentration, Biomass.

Population and reproductive dynamics of the oligochaete Nais communis were studied from August 1982 to November 1983 in a Wisconsin limnocrene (a spring discharging into a small basin which overflows into a stream channel). The study site was located in the township of Saukville, Ozaukee County. Naidids were found only among the large floating mats of Spirogyra which covered most of the limnocrene. Population density was significantly ($P < 0.05$) correlated with water temperature, total alkalinity and pH. Abundance peaks occurred during mid-August 1982 and early October 1983. No sexually mature worms were collected; asexual reproduction by paratomy took place throughout the study. Nais communis exhibited at most three zooids per chain; the majority of worms exhibited two zooids per chain when reproducing. There was no significant ($P > 0.05$) correlation of percentage of worms undergoing paratomy to environmental physico-chemical parameters and worm density. Mean doubling time for the field population of N. communis was 13.57 +/- 13.00 days. Seasonal changes in biomass were similar to those of abundance. (Moore-IVI)
W86-01879

SEASONAL CHANGES IN ABUNDANCE OF BROWN TROUT (SALMO TRUTTA) AND RAINBOW TROUT (S. GAIRDNERII) ASSESSED BY DRIFT DIVING IN THE RANGITIKEI RIVER, NEW ZEALAND,
Ministry of Agriculture and Fisheries, Wellington (New Zealand). Fisheries Research Div.
B. J. Hicks, and N. R. N. Watson.
New Zealand Journal of Marine and Freshwater Research, Vol. 19, No. 1, p 1-10, 1985. 1 Fig, 6 Tab, 17 Ref.

Descriptors: *Trout, *Seasonal variation, *Rangitikei River, *New Zealand, Drift diving, Fish, Abundance.

Numbers and approximate sizes of brown trout (Salmo trutta L.) and rainbow trout (S. gairdnerii Richardson) were estimated by snorkel divers at 6 sites in the middle reaches of the Rangitikei River, North Island, New Zealand, over 14 months. The results showed that different species and sizes of trout varied in abundance with time. The species of fingerling trout (6-12 cm FL) could not be identified because of their small size and shoaling behavior. Rainbow trout abundance varied seasonally and was greatest in January and April (between 18 and 60 fish per kilometer) when fish between 23 and 38 cm FL were the most abundant size class. Brown trout abundance showed much less variation with time (between 5 and 36 fish per kilometer at most sites). Also in contrast to rainbow trout, the majority of brown trout were > 38 cm FL, and in June, when the greatest density was observed (56 fish per kilometer), 70 redds were

seen at the same site. Two sites were dived within a 48 h period to test the variability of the method. Comparisons between the 3 dives at each site revealed no significant differences between the numbers of fish in different species and size classes. (Author's abstract)
W86-01910

NUTRIENT DEMAND AND AVAILABILITY AMONG PLANKTONIC COMMUNITIES - AN ATTEMPT TO ASSESS NUTRIENT LIMITATION TO PLANT GROWTH IN 12 CENTRAL VOLCANIC PLATEAU LAKES,
Department of Scientific and Industrial Research, Taupo (New Zealand). Div. of Marine and Freshwater Sciences.
E. White, K. Law, G. Payne, and S. Pickmere.
New Zealand Journal of Marine and Freshwater Research, Vol. 19, No. 1, p 49-62, 1985. 3 Fig, 5 Tab, 26 Ref.

Descriptors: *Limiting nutrients, *Phytoplankton, *Lakes, *New Zealand, Nitrogen, Phosphorus, Algal growth, Bioassays, Nutrient storage.

Water from 12 central volcanic plateau lakes in New Zealand was studied on 4 occasions (one in each season). Four assays of nitrogen demand and 3 for phosphorus were employed in an attempt to identify the nutrients limiting plankton growth. Orthophosphate turnover times chlorophyll, and a range of analyses for nitrogen and phosphorus were made in support of bioassays. Consideration was given to both statistical and biological interpretation of the assays. The study did not produce a clear guide to the assessment of nutrient limitation among natural plankton communities. The phosphorus bioassays assess depletion of storage products rather than the levels of phosphorus in cells at which growth becomes limited. The same is true for most of the nitrogen bioassays, with the added complication that the analytical procedures may be too insensitive to assess depletion of storage products. Some advance can be made in understanding the nutrient status of planktonic communities at least in these 12 lakes, because it is possible to assemble a package of bioassays and measurements with criteria which identify waters in which nutrient limitation by either nitrogen or phosphorus is not operative. The data indicate that the storage capacity for phosphorus is c. x5 the subsistence level, and that for nitrogen may be only c. x0.5. If the storage capacity for phosphorus is indeed an order of magnitude greater than that for nitrogen, then phosphorus storage products must be depleted to 10% of their maximum before phosphorus limitation of plant growth becomes a possibility. (Moore-IVI)
W86-01911

INVESTIGATION OF SAMPLING STRATEGIES FOR LAKE BENTHOS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
B. V. Timms.
New Zealand Journal of Marine and Freshwater Research, Vol. 19, No. 1, p 71-78, 1985. 1 Fig, 6 Tab, 27 Ref.

Descriptors: *Benthos, *Sampling, *Lakes, Seasonal variation, Lake Pearson, New Zealand, Line transects, Abundance, Population dynamics.

Lake benthos is difficult to sample to obtain accurate estimates of population parameters. Part of the apparent variation in community structure and abundance of macrobenthos between lakes is attributable to the different sampling strategies used. Sampling was carried at Lake Pearson, Canterbury, New Zealand monthly from August 1978 to July 1979 at 12 sampling stations. A comparison of 7 sampling options shows that spot samples and line transects are inadequate but that an augmented line transect is almost as good as stratified random sampling. Winter/early spring and summer samples are needed to account for seasonal variations in species richness and community biomass. Much less effort is required for an augmented line transect, therefore it is recommended for lake survey and management studies. If large species such as mussels occur, it should be realized that this program is inadequate to sample them and either numerous grabs are needed in one period or over a seasonal cycle, or some other sampler should be used. (Moore-IVI)
W86-01913

2I. Water In Plants

EFFECTS OF WATER AND MINERAL NUTRIENT SUPPLY ON A DECIDUOUS AND AN EVERGREEN DWARF SHRUB: VACCINIUM ULIGINOSUM L. AND V. VITIS-IDAEA L.,
Lund Univ. (Sweden). Dept. of Plant Ecology.
P. S. Karlsson.
Holarctic Ecology, Vol. 8, No. 1, p 1-8, March, 1985. 6 Fig, 2 Tab, 51 Ref.

Descriptors: *Nutrients, *Minerals, *Water requirements, Plant growth, Fertilization, Soil properties, Climate, Precipitation, Roots, Evergreen shrubs, Deciduous shrubs.

At time of harvest, in response to fertilization, the deciduous Vaccinium uliginosum had accumulated more nutrients and grown more than the evergreen V. vitis-idaea. This study aimed at testing whether a similar response would be obtained in these species after fertilizing a site that differed from that used in the earlier study both in soil and climate characteristics. The present study was conducted at Abisko, northern Sweden, at a well drained site with a thin layer of organic soil, no permafrost, and relatively low annual precipitation. It is concluded that a sized response pattern cannot be expected for evergreen and deciduous species without considering other plant characteristics such as the amount of roots and (perhaps still more important) the spatial distribution of the roots in the soil. Such differences within a growth form group may be further accentuated by differences in climate, mainly precipitation, and soil quality between sites. The different response patterns recorded for V. vitis-idaea and V. uliginosum in the present study as compared to the earlier study may be result of such site differences. (Baker-IVI)
W86-01360

CANOPY TRANSPIRATION AND WATER FLUXES IN THE XYLEM OF THE TRUNK OF LARIX AND PICEA TREES - A COMPARISON OF XYLEM FLOW, POROMETER AND CUVETTE MEASUREMENTS,
Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Pflanzenoekologie.
E. D. Schulze, J. Cermak, R. Matyssek, M. Penka, and R. Zimmermann.
Oecologia, Vol. 66, No. 4, p 475-483, July, 1985. 7 Fig, 1 Tab, 38 Ref.

Descriptors: *Canopy, *Transpiration, *Xylem, *Trees, *Larix, *Picea, *Porometers, Plant tissues, Plant physiology, Leaves.

Leaf gas exchange, transpiration, water potential and xylem water flow measurements were used in order to investigate the daily water balance of intact, naturally growing, adult Larix and Picea trees without major injury. The total daily water use of the tree was very similar when measured as xylem water flow at breast height or at the trunk top below the shade branches, or as canopy transpiration by a porometer or gas exchange chamber at different crown positions. The average canopy transpiration is about 12% lower than the transpiration of a single twig in the sun crown of Larix and Picea. Despite the similarity in daily total water flows there are larger differences in the actual daily course. Transpiration started 2 to 3 h earlier than the xylem water flow and decreased at noon before the maximum xylem water flow was reached, and stopped in the evening 2 to 3 h earlier than the water flow through the stem. The daily course of the xylem water flow was very similar at the trunk base and top below the lowest branches with shade needles. The difference in water efflux from the crown via transpiration and the water influx from the trunk is caused by the use of stored water. The specific capacitance of the crown wood was estimated to be 4.7 x 10 to the minus 8th power and 6.3 x 10 to the minus 8th power kg/kg/Pa and the total amount of available wate
was 17.8 and 8.7 kg, which is 24% and 14
total daily transpiration in Larix and Picea
tively. Very little water was used from
tree trunk. With increasing transpiration a
stored water from wood in the crown, t
potential in the foliage decreases. Plan
status recovers with the decrease of tran
and the refilling of the water storage a
liquid flow conductance in the trunk was
to the minus 9th power and 0.36 x 10 to t
9th power mol/sq m/s/Pa in Larix a
respectively. The role of stomata and thei
by environmental and internal plant facto
cussed. (Author's abstract)
W86-01601

**COMPARATIVE WATER RELATIONS
JACENT CALIFORNIA SHRUB AND
LAND COMMUNITIES,**
Pepperdine Univ., Malibu, CA. Natural
Div.
S. D. Davis, and H. A. Mooney.
Oecologia, Vol. 66, No. 4, p 522-529, July,
Fig, 1 Tab, 34 Ref.

Descriptors: *California, *Grasslands,
*Plant physiology, Chaparral, Drough
stress, Plant populations, Soil moisture.

Much of the coastal mountains and fo
central and southern California are cove
mosaic of grassland, coastal sage scrub,
green sclerophyllous shrubs (chaparral).
cases, the borders between adjacent plan
nities are stable. The cause of this stabil
known. The water use patterns of repre
grasses, herbs, and shrubs across a grass
parrel ecotone were examined and the
which patterns of water use contribute t
stability was determined. The effects of
persal and animal herbivory were also
During spring months, when water was
ed, grassland species had a much higher
ductance to water vapor diffusion than
plants. As the summer drought progress
land species depleted available soil mois
bare zone plants second, and chaparral t
one chaparral species (Quercus durata) sh
evidence of water stress. Soil moisture
patterns with depth and time corresp
plant water status and root depth. Rab
vory was highest in the chaparral and ba
indicated by high densities of rabbit pe
persal of grassland seeds into the cha
bare zone was low. Results support the h
that grassland species deplete soil moist
upper soil horizon early in the drought, p
the establishment of chaparral seedling
zone herbs. Also, grassland plants are
from invading the chaparral because of
dispersability and high animal herbivory
regions. (Author's abstract)
W86-01602

**WATER RELATIONS OF PINUS RAD
COMPETITION WITH WEEDS,**
Melbourne Univ., Parkville (Australia).
Section.
R. Sands, and E. K. S. Nambiar.
Canadian Journal of Forest Research, Vo
2, p 233-237, 1985. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Pine trees, *Water stress,
tion, *Weeds, Stomatal resistance, Wa
tials, Needles, Roots, Diurnal variation.

Soil water profiles up to 2 m in depth a
patterns of needle water potential and
resistance were measured over a dry
period in 5-, 16-, and 28-month-old ra
(Pinus radiata D. Don) plantations, gro
and without weed competition. Severe w
with consequent productivity loss oc
trees with weed competition but the s
stress decreased progressively with incr
age. Transplanted seedlings in their firs
season had shallow root systems which
efficiently exploit water at depth. By
seedlings in their second and third growi

ed water from at least a depth of 2 m. Trees
weed competition were not water stressed
is period even when planted at three times
rmal stocking rate. Thus there is consider-
pacity to increase early growth rates of
pine without water being the limit to
lf weeds are adequately controlled. (Au-
stract)
777

ATION OF TWIG XYLEM WATER PO-
AL IN YOUNG DOUGLAS-FIR TREES,
Columbia Univ., Vancouver. Dept. of Soil

lliher, T. A. Black, and A. G. Barr.
Journal of Forest Research, Vol. 14, No.
487, August, 1984. 7 Fig, 3 Tab, 49 Ref.

ors: *Water potential, *Fir trees, *Xylem,
er potential, Transpiration, Needles, Water

er stress can be an important factor deter-
productivity of some North American
orests. Leaf (needle) water potential is a
f tree water stress. A method is described
n be used to estimate twig xylem water
for 10-15 m tall Douglas-fir (Pseudotsuga
) trees. Using pressure chamber measure-
lues of needle xylem water pressure po-
ere found to be similar to twig xylem
ssure potential. Pressure chamber meas-
were reproducible and needle deforma-
not observed. For root zone soil water
> -0.4 MPa, measured predawn total
m water potential of these Douglas-fir
significantly less than the soil water
A transpiration rate dependent single soil
quid resistance accounted for the differ-
veen predawn total twig xylem water
and soil water potential. For soil water
> -0.4 MPa, during the daytime when
on was high, twig liquid resistance could
ed by a logarithmic function of soil
ential. The effect of capacitance on twig
er potential was small. A model incorpo-
transpiration dependent twig liquid re-
curately estimated the course of twig
er potential on a clear day when soil
ntial was -0.04 MPa. (Moore-IVI)

ENT FOR MEASURING THE AVER-
MATAL CONDUCTANCE OF CONI-
LINGS,
umbia Univ., Vancouver. Dept. of Soil

gston, T. A. Black, D. Beames, and B.
rth.
ournal of Forest Research, Vol. 14, No.
7, August, 1984. 7 Fig, 1 Tab, 13 Ref.

: *Stomatal conductance, *Conifers,
instruments, Porometers, Conduct-
es, Seedlings, Microprocessors.

d, transient-type porometer was de-
ondestructively measure the average
nductance of conifer seedlings. The
consists of a low-power microprocessor
stainless steel chamber which encloses
. Conductance is calculated from the
te of increase in chamber relative hu-
ve the ambient level. Consequently,
does not have to be dried prior to
t. Direct readout of stomatal conduct-
ided by means of liquid crystal display
(RS232) port. Porometer calibration
e of humidities showed that the effec-
r volume was consistently 25% larger
tual chamber volume. Stomatal con-
easurements made on Douglas-fir
a menziesii (Mirb.) Franco) seedlings
orometer agreed well with average
ed with a ventilated diffusion porome-
our needle samples. The porometer
e very convenient to use in a forest
ironment, with the measurement pro-
g about 1 min. Measurements can be
eedling over the growing season be-
e of the instrument causes no injury to
es, and needles. (Author's abstract)
W86-01782

LIGHT REDUCTION AND MOISTURE STRESS: EFFECTS ON GROWTH AND WATER RELATIONS OF WESTERN LARCH SEEDLINGS,
Oregon State Univ., Corvallis. Coll. of Forestry.
N. C. Vance, and S. W. Running.
Canadian Journal of Forest Research, Vol. 15, No. 1, p 72-77, February, 1985. 4 Fig, 2 Tab, 30 Ref.

Descriptors: *Larch trees, *Water stress, *Plant growth, Solar radiation, Leaves, Water potential, Seedlings, Humidity, Conductance.

Ten-week-old western larch (Larix occidentalis Nutt.) seedlings were grown in a greenhouse under 70, 37, and 27% full sunlight from late July to early October. In August, seedlings under each light treatment were repetitively water stressed until predawn leaf water potential reached one of three levels: no stress (> -0.4 MPa), moderate stress (-0.7 to -1.0 MPa), and severe stress (-1.5 to -1.8 MPa). Moisture stressing significantly reduced height and diameter of seedlings grown under 70% light. Light reduction reduced shoot and root biomass accumulation. A positive linear relation was found between root dry weight and light intensity. The largest seedlings (on a weight basis) received the highest light, were unstressed, and had the lowest shoot/root ratios. Terminal bud set was not affected by light reduction or moisture stressing but occurred under a 14-h photoperiod and reduced nighttime temperatures. Stressed and shaded seedlings had significantly reduced diurnal leaf conductance (K1), and stress-cycled seedlings showed an adjustment to stressing. The K1 of unstressed seedlings was correlated with humidity deficit (ABHD), and K1 of stressed seedlings, with leaf water potential and ABHD. Maximum K1 declined with decreasing leaf water potential but not to a level indicating complete stomatal closure. (Author's abstract)
W86-01785

NEEDLE WATER POTENTIAL AND SOIL-TO-FOLIAGE FLOW RESISTANCE DURING SOIL DRYING: A COMPARISON OF DOUGLAS-FIR, WESTERN HEMLOCK, AND MOUNTAIN HEMLOCK,
British Columbia Univ., Vancouver. Dept. of Soil Science.
T. M. Ballard, and M. G. Dosskey.
Canadian Journal of Forest Research, Vol. 15, No. 1, p 185-188, February. 1985. 3 Fig, 13 Ref.

Descriptors: *Needles, *Water potential, *Plant water uptake, *Soil water, *Hemlock, *Fir trees, Seedlings, Soil water potential, Water uptake resistance.

Trends of needle water potential and resistance to water uptake by Douglas-fir seedlings are compared to those for western and mountain hemlock. Soil-to-foliage flow resistance for various soil water potentials was calculated as the difference between soil and needle water potentials, divided by the corresponding water uptake rate. Needle water potential in western and mountain hemlock falls as the soil dries, but under the experimental conditions, it remained stable in Douglas-fir. Resistance to water flow from soil to foliage is higher for the hemlocks and increases more steeply as the soil dries. As the soil continues to dry, the effect of larger and more steeply increasing resistance, in hemlocks, is to decrease water uptake to near zero, long before the water potential difference becomes very small. This occurs although root surface area is much greater for the hemlocks than for Douglas-fir, and is especially pronounced for mountain hemlock. (Moore-IVI)
W86-01787

2J. Erosion and Sedimentation

SEDIMENT RESUSPENSION AND CURRENTS IN LAKE MANITOBA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.

For primary bibliographic entry see Field 2H.
W86-01341

HYDROLOGY OF MID-ALTITUDE TUSSOCK GRASSLANDS, UPPER WAIPORI CATCHMENT, OTAGO. I. EROSION, SEDIMENT YIELDS AND WATER QUALITY,
New Zealand Forest Service, Rotorua. Forest Research Inst.
C. L. O'Loughlin, L. K. Rowek, and A. J. Pearce.
Journal of Hydrology (New Zealand), Vol. 23, No. 2, p 45-59, 1984. 6 Fig, 4 Tab, 16 Ref.

Descriptors: *Soil erosion, *Sediment yield, *Water quality, *Grasslands, *Otago, *New Zealand, Temperature effects, Turbidity, Bank stabilization, Catchment area, Hydrology.

A study was designed to determine the erosion status of catchments under lightly modified tussock grassland and to examine the export of sediment from the catchment. The quality of the catchments' streamwater was also considered. Sediment yields from two small tussock catchments underlain by schist bedrock in the East Otago uplands South Island, New Zealand, were 42.8 cubic m and 12.6 cubic m respectively during a 4 year period of study. The area appears to have low erosion rates, as evidenced by the sediment yield rates. Surface erosion and mass wasting were not common occurrences on the catchments' slopes. Most of the sediment delivered to the streams derived from channel scouring and bank collapse during large floods. Suspended sediment concentrations ranged from less than 2 mg/l to 430 mg/l and the streamwaters remained clear at less than 15-20 mg/l sediment concentration for about 97% of the time. Stream pH averaged 6.8, stream conductivity ranged from 12.4 to 54.8 micro-S/cm and stream temperature ranged between maxima of 16 to 19 degrees C in summer and minima of 0-3 degrees C in winter. (Baker-IVI)
W86-01383

SOME THOUGHTS ON FINE-GRAINED SEDIMENT TRANSPORT AND DEPOSITION,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
D. S. Gorsline.
Sedimentary Geology, Vol. 41, No. 2/4, p 113-130, December, 1984. 118 Ref.

Descriptors: *Sediment transport, *Deposition, Sedimentation, Particulate matter, Plankton, Marine environment.

Some aspects of fine-grained sedimentary research are reviewed. Water circulation is instrumental in determining the distribution of these particulates. Planktonic biologic filtering, aggregation, and reworking are of primary importance in deposition. Early diagenesis is controlled by bacterial processes with consequent changes in bulk and chemical properties. Initial deposition of most fine particulates is in the continental margins and then it moves to deep-ocean floors by mass wasting and high concentration flows. The stability of these fine deposits even on slopes of gentle gradient is controlled primarily by water content which, in turn, is a function of sedimentation rate and texture of the supply. Mass transport can occur in a variety of forms from slow creep to catastrophic failures of large scale. The various forms of movement can cause a sequence of morphologies. Most of the fine-grained stratigraphic record urgently needs reevaluation and restudy. Models of paleogeographic reconstructions on a large scale need to include the results of physical and biological oceanographers as the older simpler scenarios of locations of zones of high bioproductivity and of the patterns of major ocean currents have been greatly modified in recent studies. (Baker-IVI)
W86-01397

CHANGES IN SEDIMENT COMPOSITION DURING SEASONAL RESUSPENSION IN SMALL SHALLOW DIMICTIC INLAND LAKES,
Wisconsin Univ.-Platteville. Dept. of Geosciences.

E. B. Nuhfer, and R. Y. Anderson.
Sedimentary Geology, Vol. 41, No. 2/4, p 131-158, December, 1984. 13 Fig, 5 Tab, 36 Ref.

Descriptors: *Resuspension, *Sedimentation, *Lake sediments, Edinboro Lake, Pennsylvania, East Twin Lake, Ohio, Kettle lakes, Chemical analysis, Calcium, Phosphorus, Sulfur, Magnesium, Sodium, Zinc, Nickel, Chromium, Manganese, Iron, Aluminum, Seasonal variation.

Results are presented of resuspension studies at two small shallow kettle lakes, Edinboro Lake, Pennsylvania, and East Twin Lake, Ohio. These lakes have significant amounts of seasonal resuspension and measurable accompanying variations in seston with respect to chemistry, mineralogy, and petrography. The objectives of the work were to study the magnitude and duration of resuspension events; and to acquire sufficient chemical, mineralogical, and petrographic data from an annual record to permit both detection of seasonal variations and statistical analyses of relative importance of detected variations. Resuspension in the lakes occurs from both seasonal holomictic circulation and from continual entrainment of material from the shallow portions of the lake by the circulating epilimnion. Trapping rates were only negligibly affected by rainstorms. These rates varied widely throughout the year with minimum sedimentation rates noted at time of winter ice cover, and maximum rates noted during autumn circulation. Most material collected by the sediment traps was resuspended from the lake bottom. The only inactive time for resuspension was the time period under winter ice cover. Compositional variations included enrichment of Si in winter, Ca, P, S, Mg, Na, Zn, Ni, and Cr in summer, and Mn in late summer and autumn. During times of reduced circulation the sediment is generally enriched in amorphous mineraloids and during spring and autumn, in detrital minerals. Endogenic minerals include calcite, pyrite, and possibly some kaolinite. Most of the mineral fraction is detrital. Trap sample differs in composition from bottom sediment, but samples collected in traps in early winter closely resemble bottom material. Traping rates in early winter appear closest to true rates of fill. (Baker-IVI)
W86-01398

FURTHER EVIDENCE OF FINE-GRAINED SEDIMENT DISPERSAL IN THE SOUTHEASTERN YELLOW SEA,
Seoul National Univ. (Republic of Korea). Dept. of Oceanography.
S. K. Chough.
Sedimentary Geology, Vol. 41, No. 2/4, p 159-172, December, 1984. 8 Fig, 31 Ref.

Descriptors: *Sedimentation, *Dispersion, *Yellow Sea, China, Korea, Yangtze River, Hwangho River, Keum Estuary, Kaolinite, Chlorite, Mineralogy, Sediment transport.

The Yellow Sea is a shallow, post-glacially submerged epicontinental basin, a tectonically stable depocenter of clastics derived from the adjoining land masses of China and Korea. Sediments in the Yellow Sea are fine-grained in the broad western part, where they are derived mainly from the Chinese rivers, the Hwangho and Yangtze, and coarse-grained in the narrow eastern part originating largely from the Korean Peninsula. The coarse grained sediments near the Keum Estuary contain subtantial amounts of fine fractions. Kaolinite and chlorite are abundant in the fine fractions for about 120 km both toward the northwest and the southwest. Trace elements distributed in the bulk sediments follow the same trends. The close correspondence between mineralogical and geochemical evidence and hydrographic data suggests that the bulk of fine-grained sediments in the southeastern Yellow Sea originates from the Keum River and is subsequently transported by prevailing nearshore currents both northwestward during summer and dominantly southwestward in winter. Illite is dominant in the rest of the sea as influenced by discharge of Hwangho River and possibly also the Yangtze. There appears only to be a minimal effect from the Kuroshio discharging into the southeastern Yellow Sea. (Baker-IVI)
W86-01399

SOIL EROSION MEASUREMENT AND SOIL CONSERVATION RESEARCH IN CULTIVATED AREAS OF THE UK,
National Coll. of Agricultural Engineering, Silsoe (England).
R. P. C. Morgan.
Geographical Journal, Vol. 151, No. 1, p 11-20, March, 1985. 7 Tab, 62 Ref.

Descriptors: *Soil erosion, *Soil conservation, *Erosion control, *England, *Cultivated lands, Rill erosion, Wind erosion, Slope, Soil types.

Agricultural soil erosion by both water and wind is a local scale problem in the UK, particularly on the sandy loam soils under continuous cereal production or market gardening in the midland and eastern counties of England. Mean annual rates of soil erosion by water on these soils in fields on hillslopes up to 11 degrees can exceed 2 kg/sq m when rilling occurs, compared with a rate for top soil renewal of only about 0.1 kg/sq m. Rates as high as 1.9 kg/sq m have been recorded in individual storms and storm rates greater than 0.2 kg/sq m can occur as frequently as in four years out of seven. Storm losses by wind erosion are of similar magnitude but those for gully erosion are much higher with rates reaching 15 to 19 kg/sq m in single storms. Research into soil conservation has been carried out on Experimental Husbandry Farms and by farmers and commercial organizations with a direct interest in the problem. It has been largely limited to the use of shelterbelts, guard crops, soil stablizers and land imprinting or pressing to control wind erosion with virtually no work having been undertaken on water erosion control. There is a need for more fundamental research which will allow the mechanics of the control measures to be understood better and to enable their general applicability to be assessed more readily. Research projects with these aims in mind are described involving investigations of the effects of crop cover on splash erosion, tillage effects on soil erodibility and the simple modelling of the erosion system to predict the stability or instability of the soil resource under given systems of agricultural management. (Author's abstract)
W86-01401

SOIL EROSION AND SEDIMENT TRANSPORT RESEARCH IN TROPICAL AFRICA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Lal.
Hydrological Sciences Journal, Vol. 30, No. 2, p 239-256, June, 1985. 3 Fig, 3 Tab, 107 Ref.

Descriptors: *Soil erosion, *Erosion, *Sediment transport, *Africa, *Research, Sediment load, Land use, Deforestation, Environmental protection.

The magnitude of soil erosion in tropical Africa is reviewed and related to erodibility, erosivity and landform in different ecological regions. There are few direct measurements of erosivity and erodibility in tropical Africa and the relevance of using the Universal Soil Loss Equation in estimating these parameters is reviewed. Soil erodibility is not a fixed parameter and changes with time. Although localized rates of soil erosion can be high, the erosion rates derived from sediment loads in rivers are often low. Most of the available data on sediment loads of African rivers are 10-20 years old, and little research information is available on the delivery ratios associated with different catchments. Rapidly changing land use is one of the major factors responsible for accelerated soil erosion, and the effects of deforestation, grazing, fire, and of cultural practices are discussed. The economics of soil erosion is reviewed in terms of loss in productivity and siltation of reservoirs. Research and development needs are listed. (Author's abstract)
W86-01447

ESTIMATING UNIVERSAL SOIL LOSS EQUATION FACTOR VALUES WITH AERIAL PHOTOGRAPHY,
Ministry of Works and Development, Palm
North (New Zealand) Water and Soil Div
P. R. Stephens, J. K. MacMillan, J. L. Daigl
J. Cihlar.
Journal of Soil and Water Conservation, V
No. 3, p 293-296, May-June, 1985. 3 Fig, 5
Ref.

Descriptors: *Aerial photography, *Infra
agery, *Soil loss, Soil erosion, Mapping, Cr
tion, Farm management, Slope, Soil type,
sensing, Croplands.

Traditionally, inputs for the universal s
equation have been based on cropland a
erosion estimates obtained from field surv
farmer interviews. But such data can also
tained by using color-infrared photographs
lineate (a) homogeneous erosion mapping
crop rotations, and management practic
topographic maps for slope information; an
improved soil map for soil erodibility. T
procedure was tested in a potato growing a
Grand Falls, New Brunswick. With accur
erodibility data, soil loss was estimated
accuracy of 88% +/- 1.2% compared to th
tional method. Such accuracy is sufficient
conservation planning. Accuracy dropped
+/- 2.5% when the existing soil map (1
scale) was used. The new method is two
times faster and permits year-round mappin
pared to about 120 days for the traditional
in the study area. Aerial photographs also
a valuable land cover record for future u
thor's abstract)
W86-01493

**NITROGEN MINERALIZATION IN
QUENCE OF HYDROMORPHIC SOIL
VALLEY IN THE HIGH SEMOIS (BEL
(MINERALISATION DE L'AZOTE DAN
SEQUENCE DE SOLS HYDROMORPH
LA VALLEE DE LA HAUTE SEMOIS (
QUE)),**
Universite Libre de Bruxelles (Belgium).
Botanique Systematique et d'Ecologie.
For primary bibliographic entry see Fi
W86-01510

**GENERALIZED CONTINUUM THEOR
MULTIPHASE SUSPENSION FLOWS,**
Clarkson Univ., Potsdam, NY. Dept. of M
cal and Industrial Engineering.
G. Ahmadi.
International Journal of Engineering Scien
23, No. 1, p 1-25, July, 1985. 118 Ref.

Descriptors: *Continuum theory, *Su
solids, *Multiphase suspension flow, Pa
matter, Thermodynamics, Mathematical e
Sedimentation.

A continuum theory for multiphase particu
pensions in a fluid media is formulated. Th
alized fundamental balance laws for the pa
phases as well as for the continuous su
fluid phase are presented. The thermodyn
a multiphase system is studied and the m
Lagrangian multipliers is employed to inc
constraints of incompressibility of materia
constituents and the criterion for fully
media. Constitutive equations are develope
include microrotational and microdilationa
The basic equations of motion of differen
are derived and discussed. Special consi
are given to the case of incompressible
ents. Examples of applications of the
theory to dilute suspension flows and m
sedimentation are also discussed. (Auth
stract)
W86-01533

**FORMATION OF RIPPLES IN ER
CHANNELS,**
Delaware Univ., Newark. Ocean Enginee
gram.
N. Kobayashi, and O. S. Madsen.
Journal of Geophysical Research, Vol. 90
p 7332-7340, July, 1985. 5 Fig, 1 Tab,

ors: *Ripple marks, *Erodible channels, ynamic models, *Model studies, Hydrau- d mechanics, Sediment.

n of ripples and dunes in erodible chan- analyzed by using the hydrodynamic veloped by Kobayashi and Madsen. Ap- e continuity equation of sediment, the on velocity of the wavy bed is expressed of the new fluxes of bed load along the and suspended sediment out of the bed sport layer. The spatial variation of the ransport rate is derived by analyzing the f forces acting on a representative bed cle on a sloping bed. The net flux of the sediment out of the bed load transport otained by solving the diffusion equation uspended sediment near the bed. The alysis predicts that a perturbation that is ly short or long relative to the depth of nitially grow, depending on whether the draulically smooth or fully rough. The lains why ripples are not observed in ts involving fairly coarse sediments, ese cases the flow is rough turbulent. bstract)

ICAL MODEL FOR SALTATING N WATER,
n Univ., Seattle. Geophysics Program.
g, and J. D. Smith.
Geophysical Research, Vol. 90, No. C4, 4, July, 1985. 17 Fig, 2 Tab, 30 Ref.

: *Sediment transport, *Geophysics, Streambeds, Particulate matter, Model id mechanics.

ns of motion for a sediment grain near ive bed and those for the local fluid mbined to produce a set of differential iat can be solved numerically to de- ajectory of a saltating grain as a func- . The lift coefficient is set based on a f data produced by Chepil, and the neters of the problem are set using id mechanical relationships; the initial position are specified with a separate heights of the resulting trajectories are e significantly lower than available ts would indicate; therefore two exten- model are examined: the effect that form lift have on a series of trajector- effect of partially elastic collisions oving grain and the bed over which it A model that includes the second ss complicated than one that includes it yields trajectories that agree very vailable experimental measurements und coefficient that varies around 0.5 on the impact momentum is used. The les a reasonable representation of sal- er and both fluid-solid and solid-solid re required to reproduce the param- sured trajectories. (Author's abstract)

RISTICS OF SUSPENDED SEDI- ANSPORT IN THE LOWER VER,
f New York at Stony Brook. Marine earch Center.
cz, and C. L. Arnold.
Environmental Science, Vol. 3, No. . 2 Fig, 1 Tab, 29 Ref.

*Sediment transport, *Hudson River, *Suspended sediment, Particle size, tants, Estuarine environment, Phys- haracteristics.

uspended particles, and the contami- ted with them, undergo episodic heir downstream migration and do follow the water motion. Below the NY, the suspended sediment trans- tially modified by tidal resuspension agglomeration. Samples taken sea- tations had an average concentration anging from 28 mg/l during low freshwater discharge to 40 mg/l at times of high discharge. The concentrations were increasingly controlled by tidal resuspension towards the month where tidal discharges are typically 20 times the freshwater discharge. The average percentage weight loss on ignition was 22%. Measurements of the particle-size distributions in both undisturbed and disaggregated samples showed that suspended particles were usually mineral-organic aggregates. In contrast to resuspension which increases the time particles spend in the water column, agglomeration tends to decrease that time by increasing the settling velocity. Most of the fine-grained sediment distribution occurs in the geochemical estuary and a substantial amount of this sediment is ultimately dredged and disposed in the ocean. (Author's abstract)
W86-01559

SEDIMENT ACCUMULATION RATES IN IRONDEQUOIT BAY, NEW YORK BASED ON LEAD-210 AND CESIUM-137 GEOCHRONOLOGY,
Geological Survey, San Diego, CA. Water Resources Div.
For primary bibliographic entry see Field 2L.
W86-01566

MINERALIZATION OF ORGANIC CARBON ON AND IN THE SEDIMENT OF LAKE GREVELINGEN,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
For primary bibliographic entry see Field 2H.
W86-01579

FORMATION OF PYRITE IN FRESHWATER SEDIMENTS: IMPLICATIONS FOR C/S RATIOS,
Freshwater Biological Association, Ambleside (England).
W. Davison, J. P. Lishman, and J. Hilton.
Geochimica et Cosmochimica Acta, Vol. 49, No.7, p 1615-1620, July, 1985. 3 Fig, 1 Tab, 28 Ref.

Descriptors: *Pyrite, *Sediments, *Carbon/sulfur ratio, Lake sediments, Redox status, Volatile compounds, Sulfur.

The vertical distribution of pyrite, acid volatile sulfide (AVS), carbon, and total S (St) were determined directly in the sediments of three lakes of different trophic status. The results showed that freshwater pyrite formation reflects the redox status of the sediment of overlying waters. It appears to form chiefly in reducing sediments which are subject to oxidizing influences, by either a low turnover of organic carbon or periodic incursions of oxygen. Although there are high concentrations of AVS in the near-surface sediments of productive lakes, very little is diagenetically converted to pyrite. The feasibility of using sulfur ratios to diagnose whether rocks were formed in marine or freshwater environments is assessed. New values for FeS2/S of 0.5-5 show that this ratio does not provide a reliable test. Values of C/Sp, where Sp represents pyrite sulfur, lie within the range of 160-700 and are much higher than previously measured ratios of C/St of 1-50. These new determinations show that, if pyrite sulfur is unequivocally measured, C/S ratios may be a more sensitive indicator of salinity than had been previously thought. (Author's abstract)
W86-01615

ENERGY APPROACH TO ESTIMATING SCOUR DOWNSTREAM OF A LARGE DAM,
Vancouver (British Columbia).
For primary bibliographic entry see Field 8B.
W86-01694

USING CREAMS AND ECONOMIC MODELING TO EVALUATE CONSERVATION PRACTICES: AN APPLICATION,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
For primary bibliographic entry see Field 5B.
W86-01715

INFLOW SEEPAGE INFLUENCE ON STRAIGHT ALLUVIAL CHANNELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W86-01731

DETERMINATION OF RIPPLE GEOMETRY,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W86-01732

PREDICTION OF 2-D BED TOPOGRAPHY IN RIVERS,
Waterloopkundig Lab. te Delft (Netherlands).
N. Struiksma.
Journal of Hydraulic Engineering, Vol. 111, No. 8, p 1169-1182, August, 1985. 7 Fig, 2 Tab, 12 Ref, 1 Append.

Descriptors: *River beds, *Topography, *Mathematical models, Bed load, Sediment transport, River mechanics, River morphology.

Mathematical models are being developed at the Delft Hydraulics Laboratory for the computation of time-dependent, two-dimensional bed deformation in alluvial rivers. A most promising verification of the predictive capacity of one such model has been obtained for the Waal River in the Netherlands. This model was developed for rivers with dominant bed load transport without significant grain-sorting effects and with approximately constant width. Also, some results of computations with variable boundary conditions are given which simulate the effect of the river regime and the extraction and return of cooling water on the bed topography. (Author's abstract)
W86-01734

BRAHMAPUTRA RIVER, ASSAM, INDIA: PHYSIOGRAPHY, BASIN DENUDATION, AND CHANNEL AGGRADATION,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
D. C. Goswami.
Water Resources Research, Vol. 21, No. 7, p 959-978, July, 1985. 18 Fig, 6 Tab, 61 Ref.

Descriptors: *Brahmaputra River, *India, *Physiography, *Aggradation, *Erosion, Sediment transport, Suspended sediments, Sediment load, Channels, Himalayas, Geology.

The Brahmaputra River in Assam, India, characterized by high seasonal variability in flow, sediment transport, and channel configuration, experienced a secular period of aggradation from 1971 to 1979. The suspended load budget indicates an overall aggradation of the 607-km Assam reach of the Brahmaputra by about 16 cm during that period, with about 70% of the suspended sediment inflow into the reach being retained in the channel. Expressed as a percentage of the change in storage for the different reaches, computed errors due to sampling variability in sediment discharge generally lie within about 5-15% and do not appear to be large enough to affect the conclusions drawn from the suspended load budget. For a 145-km reach of the Brahmaputra, an alternative method based on measurement of channel cross sections suggests 21 cm of aggradation, somewhat more than estimated by the suspended load budget. Based on the suspended load carried by trans-Himalayan rivers, the present rate of denudation of the eastern Himalayas is estimated to be 73-157 cm/1000 years. The average rate for the last 2-3 million years, estimated from the volume of alluvial fill in the Brahmaputra valley in Assam, the sediment yield of the Himalayan rivers, and assuming a total yield to deposition ratio of 1.4 (present study), is 3 cm/1000 years. The current high rate of denudation of the Himalayas may be attributed mainly to the rapid uplift of the mountain system, recent earthquake activity, and high susceptibility of geologic formations to erosion by running water coupled with the effectiveness of the monsoon rainfall regime. (Author's abstract)

W86-01768

LIMITS ON THE USEFULNESS OF EROSION-HAZARD RATINGS: EXPERIENCES IN NORTHWESTERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
For primary bibliographic entry see Field 4D.
W86-01783

SHORELINE EVOLUTION ALONG THE NORTHERN COAST OF THE GULF OF MEXICO,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
D. Nummedal, R. F. Cuomo, and S. Penland.
Shore and Beach, Vol. 52, No. 1, p 11-17, January, 1984. 12 Fig, 30 Ref.

Descriptors: *Erosion, *Coastal waters, *Shores, *Gulf of Mexico, *Louisiana, Sedimentation, Barrier islands, Sea level, Water level.

The change in position of the sedimentary shoreline along the coastal waters of Louisiana over time is a function of the relative rates of sedimentation and sea level change. The morphology and evolutionary history of barrier islands along the northern coast of the Gulf of Mexico clearly document how differences in the rates of sea level rise and sediment supply controls shoreline evolution. The development on the Mississippi deltaic plain in Louisiana has been one of episodic delta progradation, abandonment, and wave reworking of fluvial distributary sand bodies to generate flanking barrier islands. The central headlands have retreated by surface erosion; on the flanks a set of regressive barriers developed as long as they could be sustained by sediment supply from the eroding updrift headland. Rapid local relative sea level rises ultimately remove the source from the transport system. At that time, the flanking regressive barriers are drowned by the rising sea; the transgressive barriers on the central headland are probably removed by sustained shoreface retreat. Provided there is enough sand on the upper delta plain, a new cycle of barrier island development may be initiated. Rapid sea level rise facilitates the drowning of major coastal barriers and sudden, dramatic landward shifts in the shoreline. Slower rates of sea level rise permit the local development of large regressive sequences as long as sediment supply is present. The ultimate fate of the shoreline under this regime appears to be shoreface erosion of nearly the complete coastal depositional sequence. (Baker-IVI)
W86-01830

COASTAL EROSION IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Marine Sciences.
J. Morelock.
Shore and Beach, Vol. 52, No. 1, p 18-27, January, 1984. 21 Fig, 4 Ref.

Descriptors: *Puerto Rico, *Erosion, *Coasts, Erosion control, Aerial photography, Beach erosion, Accretion, Flood control.

Using a series of aerial photographs from 1936, 1950-51, 1962-63, 1971, and 1977, ten sites of severe coastal erosion in Puerto Rico were studied. El Tuque Park is a public beach west of Ponce. From 1971 to 1977 the straightened shoreline at the most rapidly eroding sites had a rate of erosion of 1.7 m/yr, which compares favorably with the rate of loss of shoreline at this point from 1962 to 1971 which was 7.2 m/yr. At Playa Cortada the present pattern of erosion poses a problem for houses that were built at the waterfront east of the old pier. Aguada has a beach which is a partial foreshore that terminates in an eroding cliff reached by high wave conditions. The period of accretion from 1937 to 1950 may have been caused by an influx of flood sediments. Between 1950 and 1977 there has been a loss of 25 m of shoreline, and the rate of erosion has been increasing. The area has changed from a developed beach profile to the partial foreshore as erosion moved inland and cut into higher ground. At Punta Salinas major modifications have been carried out. The Bayamon River has been closed off from discharge into the bay and flood control channels and jetties have been built to stem the tide of erosion. Isla Cabras, prior to 1971, gave no signs of erosional changes in the shoreline. Between 1971 and 1977, however, there is a drastic change at the southeast corner of the island with erosion occurring at a rate of 3.35 m/yr. Arecibo showed 35 m of shoreline retreat in the southern part of the bay between 1940 and 1959 for an annual rate of 1.7 m. The 1962 to 1971 photographs showed a moderate rate of erosion at the point of Punta Iglesia and a rate of 1.7 m/yr of eroding north of the sand borrow pit. Findings are also presented for Punta Uvero, Boca de Cangrejos, Pozuela, and Law Mareas. A program was recommended in 1978 which called for the classifying of the shoreline in terms of erosion hazard as a corollary to the flood warning classification of coastal areas. (Baker-IVI)
W86-01831

NEWLY DISCOVERED EVIDENCE FROM THE SAN DIEGO COUNTY AREA OF SOME PRINCIPLES OF COASTAL RETREAT,
Scripps Institution of Oceanography, La Jolla, CA.
G. G. Kuhn, and F. P. Shepard.
Shore and Beach, Vol. 51, No. 1, p 3-12, January, 1983. 20 Fig, 25 Ref.

Descriptors: *Erosion, *San Diego County, *Califonia, Erosion control, Flood control, Shores, Coastal waters, Beach erosion, Breakwaters, Groundwater.

The study of coastal changes of San Diego County has thrown some light on coastal erosion along shoreline areas of moderate relief. The development of the breakwater at the entrance of San Diego Bay has demonstrated the importance of beach erosion in the vicinity of the Hotel Del Coronado. Artificial shoreline protection has become necessary in this same vicinity to forestall erosion where huge condominiums have recently been constructed on the sand. The study of Oceanside and areas to the south showed that the general interpretation of the dominance of southflowing sediment-transporting currents is not always applicable. Groundwater must have dissolved the calcareous sandstone cement along remnant shear zones in the Solana Beach area, producing caverns which weaken adjacent cliffs. The high cliffed area from Torrey Pines south to La Jolla show the importance of groundwater, accentuated by man's activities, and huge landslides. The low alluvial cliffs in the vicinity of Scripps Institution show the importance of changing weather cycles and coastal erosion since wide beaches develop during quiet periods with little cliff retreat and give a false sense of security to building sites along the bluff edges. (Baker-IVI)
W86-01832

BASIC PRINCIPLES OF SEDIMENT BUDGET STUDY IN THE COASTAL ZONE,
Odesskii Gosudarstvennyi Univ. (USSR).
For primary bibliographic entry see Field 2L.
W86-01834

COMPREHENSIVE STUDY OF THE COAST OF CALIFORNIA,
Army Engineer District, Los Angeles, CA.
For primary bibliographic entry see Field 2L.
W86-01837

TARAVAL VERTICAL SEA WALL,
San Francisco City, CA.
For primary bibliographic entry see Field 2L.
W86-01841

INLETS AND BARRIER BEACH DYNAMICS: A CASE STUDY OF SHINNECOCK INLET, NEW YORK,
Patchogue, New York.
For primary bibliographic entry see Field 2L.
W86-01843

COMPUTER ASSISTED MAPPING O EROSION POTENTIAL,
British Columbia Ministry of Environmen ria. Surveys and Resource Mapping Branch
T. Vold, M. W. Sondheim, and N. K. Nagp
Canadian Journal of Soil Science, Vol. 63, 411-418, August, 1985. 1 Fig, 3 Tab, 19 Ref

Descriptors: *Soil erosion, *Erosion p *Mapping, *Computers, Algorithms, Soil ties, Soil loss, Slope.

Soil erosion potential maps and summary can be produced from existing informati relative ease with the aid of computers. S are digitized and survey infomation is a attributes for each soil. Algorithms are t pared which evaluate the appropriate d attributes (e.g. texture, slope) for each in tion. Forty surface soil erosion potenti were produced for the Lower Fraser Valle identify the most erosion-prone areas and average potential soil losses to be expecte assumed conditions. The algorithm develo lows the universal soil loss equation. Di across the landscape in the R, K, and S fa taken into account whereas the L factor i ered as a constant equal to 1.0. Worst cond bare soil (no crop cover, i.e. C = 1.0) erosion control practices (i.e. P = 1.0) sumed. The five surface soil erosion potent es are determined by a weighted averag soil loss value based both on the upper 2 mineral soil and on the proportion of the soils in the polygon. A unique polygon shown on the erosion potential map provid to computer tables which give additional tion for each individual soil within that (Author's abstract)
W86-01906

2K. Chemical Processes

PHYSICOCHEMISTRY OF THE UPPE RIVER WATERSHED: II. INFLUEN PRECIPITATION RUNOFF AND EVENTS ON THE SAN FRANCISCO
Arizona State Univ., Tempe. Dept. of Bo Microbiology.
J. J. Rampe, R. D. Jackson, and M. R. Sommerfeld.
Journal of the Arizona-Nevada Academ ence, Vol. 19, No. 2, p 115-120, 1984. 2 Fi 16 Ref.

Descriptors: *Physicochemical properties fall runoff, *Floods, *San Francisco Rive na, New Mexico, Runoff, Storm runoff, C Sodium, Nitrates, Phosphates, Ammonia.

The chemistry of a permanent desert described during flooding with regard to in major anions and cations, nutrients, trace metals, and the interactions of the s with suspended particulates. The San F River is a permanent stream rising in t Mountains and Mogollon Rim of eastern and western New Mexico. Flowing south it drains the Blue and Mogollon Moun receives its major tributary, the Blue Riv northeast of Clifton, Arizona. The river d into the Gila River 12 km southwest o above the Peconcillo Box Canyon. Du flood events stream turbidity increased 20 During increased discharge chloride conc decreased but the total quantity transp not change. The ambient concentrations of ammonia, nitrate and phosphate during flooding. Dissolved concentrations cations decreased by dilution, whereas associated concentrations and total loads noticeably. Sodium was an exception sin transported primarily into the dissolved f solved concentrations of trace elements not change or decreased slightly during whereas total concentration and tran creased dramatically. (Baker-IVI)
W86-01358

MINARY INVESTIGATION ON CHEMI-
QUALITY OF INLAND WATERS IN
,
tsugu.
des Ohara Institut fur Landwirtschaft-
ologie Okayama Universitat, Vol. 19, No.
-34, March, 1985. 1 Fig, 2 Tab, 5 Ref.

ors: *Chemical composition, *Water anal-
Kenya, Acidity, Calcium, Magnesium,
Potassium, Carbonate, Conductivity, Sa-

conductivity, pH, calcium, magnesium,
potassium and carbonate of the water
ermined at twenty sites in Kenya in order
ate its usefulness for irrigation or tap
Upstream waters were generally low in
as evidenced by Tana, Chania, Ndarugu
irika River results. Waters downstream
nerally high salinity as exemplified by the
hi River. The waters of Lakes Naivasha
ngo were fresh, while those of Lakes
nd Nakuru were sodic, even though they
ed in the Rift Valley and have no out-
iver. Except for upstream waters, natural
waters were alkaline, and carbonate con-
nese waters were considerably high. The
f calcium in natural Kenyan waters and
sium in river waters was generally lower
other countries. The sodium content of
waters in general was not so high as
with other countries. The potassium
the naturally available waters in Kenya
h higher than in the waters of other
and the average content was more than
aker-IVI)
l

L CHEMISTRY IN MINNESOTA AND
SIN AND ITS RELATION TO RAIN-
EMISTRY,
Univ., St. Paul. Dept. of Plant Patholo-

t, and S. V. Krupa.
ric Environment, Vol. 19, No. 6, p 961-
3 Fig, 6 Tab, 21 Ref.

s: *Aerosols, *Minnesota, *Wisconsin,
y of precipitation, Chemical composi-
es, Nitrates, Metals, Geochemistry.

characteristics of aerosol and rainfall
llected at five sites in Minnesota and one
t-central Wisconsin during the summer
re generally similar with respect to the
oportions of major constituents. The
lant species measured in the aerosol was
curring predominantly in the fine frac-
5 micro-m aerodynamic diameter). The
stry was also dominated by sulfate but
same extent as the aerosol. The concen-
crustal materials in both the aerosol and
llowed a gradient in which concentra-
sed with proximity of the sampling site
ie. The concentrations of crustal materi-
erosol were correlated with their con-
in subsequent rain, whereas concentra-
ner constituents were not significantly
between aerosol and rain. Since the
sampled at the surface this result pro-
nce that crustal materials were trans-
wer altitudes and were scavenged to a
ree by below-cloud mechanisms. The
omponents in aerosols were divided by
ysis into: Ammonium sulfates; crustal
nd a group containing nitrates, metals
aterials. (Author's abstract)

ATION EFFECTS OF SIMULATED
N ON THE ORGANIC MATTER OF
OIL; PRELIMINARY RESULTS,
niv., Kingston (Ontario). Dept. of

bibliographic entry see Field 5C.

ING HYDROLOGICAL SYSTEMS
OF GEOCHEMICAL PROCESSES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2F.
W86-01448

ANNUAL LOSSES OF IRON FROM MOORLAND SOILS AND THEIR RELATION TO FREE IRON CONTENTS,
Stirling Univ. (Scotland). Dept. of Environmental Science.
For primary bibliographic entry see Field 2H.
W86-01468

CARBONATE CHEMISTRY OF RECENT CHALK GROUNDWATER IN A PART OF EAST ANGLIA, U.K.,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W86-01470

ESTIMATES OF AVERAGE MAJOR ION CONCENTRATIONS IN BULK PRECIPITATION AT TWO HIGH-ALTITUDE SITES NEAR THE CONTINENTAL DIVIDE IN SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 5B.
W86-01515

DISTRIBUTION AND FLUX OF 226RA AND 228RA IN THE AMAZON RIVER ESTUARY,
Princeton Univ., NJ. Geophysical Fluid Dynamics Program.
For primary bibliographic entry see Field 2L.
W86-01535

IMPACT OF ALKALINE PARTICULATES ON PH OF RAIN WATER IN INDIA,
Indian Inst. of Tropical Meteorology, Poona.
For primary bibliographic entry see Field 5B.
W86-01606

SHORT-TERM ENDPRODUCTS OF SULFATE REDUCTION IN A SALT MARSH: FORMATION OF ACID VOLATILE SULFIDES, ELEMENTAL SULFUR, AND PYRITE,
Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.
For primary bibliographic entry see Field 2L.
W86-01614

FORMATION OF PYRITE IN FRESHWATER SEDIMENTS: IMPLICATIONS FOR C/S RATIOS,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 2J.
W86-01615

CHEMICAL COMPOSITION OF FOGWATER COLLECTED ALONG THE CALIFORNIA COAST,
California Inst. of Tech., Pasadena. W.M. Keck Lab. of Environmental Engineering Science.
For primary bibliographic entry see Field 5B.
W86-01620

RATE CONSTANTS OF REACTIONS OF OZONE WITH ORGANIC AND INORGANIC COMPOUNDS IN WATER - III; INORGANIC COMPOUNDS AND RADICALS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
J. Hoigne, H. Bader, W. R. Haag, and J. Staehelin.
Water Research, Vol. 19, No. 8, p 993-1004, 1985. 6 Fig, 2 Tab, 34 Ref.

Descriptors: *Ozone, *Reaction kinetics, *Inorganic compounds, *Free radicals, Sulfur compounds, Chlorine compounds, Nitrogen compounds, Water treatment, Chemical reactions.

The kinetics of reactions of aqueous ozone with inorganic species are of interest for the understanding of a wide variety of systems: ozone interactions in atmospheric cloudwater or urban fog; ozone impinging onto the sea surface; and drinking and cooling water treatment. Second-order rate constants are reported for reactions of ozone with 40 inorganic aqueous solutes. Included are compounds of sulfur (e.g. H2S, H2SO3, HOCH2SO3H), chlorine (e.g. Cl(-), HOCl, NH2Cl, HClO2, ClO2), bromine (e.g. Br(-), HOBr), nitrogen (e.g. NH3, NH2OH, N2O, HNO2) and oxygen (e.g. H2O2), as well as free radicals (e.g. O2(-), OH). Most of these compounds exhibit an increase in rate constant with increasing pH corresponding to their degree of dissociation. Rate constants are based on ozone consumption rates measured by conventional batch-type or continuous-flow methods and determinations of stoichiometric factors. Also listed are data determined by pulse-irradiation techniques using kinetic spectroscopy. Ozone reacts rapidly with many oxidizable inorganic aqueous solutes. Many of them are strongly or fully protected when the site of reaction becomes protonated; most inorganic acids are only reactive in their dissociated form. Ammonia also only reacts when not protonated. Therefore, at pH values below the pKa of the site of the reaction, the rate constants of such solutes generally decrease by a factor of 10 per pH decrement. (Moore-IVI)
W86-01641

222RN CONCENTRATIONS AND VARIATIONS IN UNCONFINED GROUNDWATER,
Kyoto Univ., Osaka (Japan). Research Reactor Inst.
M. Fukui.
Journal of Hydrology, Vol. 79, No. 1/2, p 83-94, July, 1985. 10 Fig, 2 Tab, 9 Ref.

Descriptors: *Radon, *Groundwater, *Spatial distribution, Precipitation, Pumping, Geology, Seasonal variation, Sampling, Wells, Japan.

The spatial and vertical distributions of Rn-222 concentration in unconfined groundwater were surveyed, and the change of the concentraiton in groundwater relative to pumping was studied. The daily change of radon concentration in groundwater was observed and the effect of precipitation on the concentration was examined. The surveyed area is located at the Research Reactor Institute of Kyoto University (Japan). Spatial distribution of radon concentrations in groundwater in the limited area of less than 200 sq m showed rather large variation, ranging from about 170 to 300 pCi/l. This may stem from differences in geology, as the boreholes which show the higher concentration of 250-300 pci/l are close to each other. The high values may be due to small differences in the volume of water withdrawn during sampling. Vertical distributions of concentration increase in unconfined groundwater were clearly obtained in summer rather than in winter due to the stability of water density, although the spatial distributions of concentration were observed in a restricted area. The extraction of groundwater leads to about a two-fold increase in the radon concentration compared with the initial value in the borehole. A steady state concentration is reached after the extraction of about 1 cu m of water. Thus it is necessary to pump more than 1 cu m to obtain a representative concentration of the steady state in unconfined shallow groundwater. A decrease in radon concentration caused by dilution by precipitation was observed when the groundwater level rises more than about 50 cm, whereas radon content increased after small rains because the water in the well could exchange with fresh groundwater. The concentration diluted by the precipitation recovers to the former level within a week. (Moore-IVI)
W86-01658

GEOCHEMICAL MASS BALANCE OF A VOLCANIC CRATER LAKE IN AUSTRALIA,
Flinders Univ. of South Australia, Bedford Park. School of Earth Sciences.
For primary bibliographic entry see Field 2H.
W86-01663

ALUMINUM MOBILIZATION IN AN ACIDIC HEADWATER STREAM: TEMPORAL VARIATION AND MINERAL DISSOLUTION DISEQUILIBRIA,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5C.
W86-01678

BIOGEOCHEMISTRY OF ALUMINUM IN MCDONALDS BRANCH WATERSHED, NEW JERSEY PINE BARRENS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W86-01704

MULTIVARIATE ANALYSIS AND INTERPRETATION OF THE HYDROCHEMISTRY OF A DOLOMITIC REEF AQUIFER, NORTHERN ITALY,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
For primary bibliographic entry see Field 2F.
W86-01773

PHOSPHORUS FORMS AND CONTENT IN NATURAL WATER AND FACTORS DETERMINING ITS CYCLING,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
N. G. Dmitrieva, and L. O. Einor.
Water Resources, Vol. 11, No. 4, p 360-370, July-August, 1984. 80 Ref. Translated from Vodnye Resursy, No. 4, p 110-120, July-August, 1984.

Descriptors: *Phosphous, *Natural waters, *Cycling nutrients, Lakes, Rivers, Runoff, Precipitation, Bottom sediments, Water analysis, Organic compounds, Aquatic life.

The formation of the quality of natural water in many respects is determined by the characteristics of hydrochemical and biochemical processes which depend on the effect of a number of factors within and outside of water bodies. The main pools of phosphorus compounds are the water itself, bottom sediments, and biota. The sources of inflow of phosphorus into water objects are the allochthonous runoff, precipitation, groundwater runoff and other factors. The anthropogenic factors of entry of phosphorus into water bodies and streams has become a powerful factor even increasing in significance. Phosphorus is present in surface waters of continental water bodies primarily in an organic form namely, in the composition of living organisms and in particles of dead material suspended in water or settled on the bottom, and in water in the form of soluble organic matter. Balance calculations of the income and outgo of P in various bodies of water is of great value, especially for predicting their state, but is an extremely difficult scientific problem. For its solution it is necessary to have a sufficiently complete and accurate data bank on all components of the phosphorus balance and their changes during a number of years. The calculations can be made as the final step of a quantitative study of sources of the inflow, accumulations, and removal of all P forms. (Baker-IVI)
W86-01811

DETERMINATION OF ZINC, CADMIUM, LEAD AND COPPER IN PRECIPITATION BY COMPUTERIZED DIFFERENTIAL PULSE VOLTAMMETRY,
Netherlands Energy Research Foundation ECN, Petten.
For primary bibliographic entry see Field 5A.
W86-01846

DETERMINATION OF COMMON ANION CONCENTRATIONS IN SURFACE AND GROUNDWATER SAMPLES BY ELUENT-SUPPRESSED ION CHROMATOGRAPHY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 5A.
W86-01847

GROUND-WATER QUALITY IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
L. R. Larson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4034, 1984. 71 p, 55 fig, 2 tab, 18 ref.

Descriptors: *Water quality, *Groundwater, *Aquifer, *Dissolved solids, Nitrates, Fluorides, Trace elements, *Wyoming.

This report graphically summarizes ground-water quality from selected chemical-quality data for about 2,300 ground-water sites in Wyoming. Dissolved-solids, nitrate, fluoride, arsenic, barium, cadmium, chromium, lead, mercury, selenium, iron, and manganese concentrations are summarized on a statewide basis. The major chemical-quality problem that limits the use of Wyoming ground-water is excessive dissolved-solids concentrations. The aquifers with the best quality water, based on the lowest median dissolved-solids concentration of water in aquifers with 20 or more sampled sites, are Holocene lacustrine deposits, the upper Testiary Ogallala Formation and Arikaree Formation, and the Mississippian Madison Limestone. The counties with the best quality water, based on the lowest median dissolved-solids concentrations are Teton County and Laramie County. Hot Springs County and Natrona County have the highest median dissolved-solids concentrations. About 3 percent of the nitrate concentrations of ground-water samples exceeded the national primary drinking-water standard of 10 milligrams per liter. Fluoride concentrations exceeded the national primary drinking-water standard in 14 percent of the ground-water samples. Except for selenium, toxic trace elements generally have not been found in concentrations in excess of the drinking-water standards. About 19 percent of the iron and about 30 percent of the manganese concentrations in ground-water samples exceeded the national secondary drinking-water standards. (USGS)
W86-01919

2L. Estuaries

COMPUTER SIMULATIONS OF THE FRASER RIVER PLUME,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
L. Royer, and W. J. Emery.
Journal of Marine Research, Vol. 43, No. 2, p 289-306, May, 1985. 7 Fig, 35 Ref. Canadian Natural Sciences and Engineering Research Council Strategic Grants Program for Oceans grant G0353.

Descriptors: *Computer models, *Plumes, *River mouth, *Fraser River, *Straight of Georgia, *British Columbia, *Salinity, Wind-driven currents, Wind velocity, Tidal effects, Water currents, Stream discharge.

Instruments sampling the engine cooling water on two B.C. ferries were used to monitor the temporal and spatial variations of the Fraser River Plume, in the central Strait of Georgia (British Columbia) for nearly two years. Travelling along two different routes north and south of the river mouth, each ferry provided eight horizontal near-surface salinity transects per day. From each transect, the arithmetic average salinity along the section (denoted southern or northern section average salinity) was extracted, formulated as a time series of hourly or daily values and then compared to equivalent computer simulated series. A numerical model, previously developed to examine the effect of tidal forcing on the plume, was modified to include as inputs the hourly wind and daily discharge data. Average model salinities along the ferry section were computed and compared to the observed ferry data. Good agreement was reached after manipulating the entrainment velocity and the momentum transfer from the wind to the plume. The tides were seen to add a relatively small tidal modulation to the general salinity pattern resulting from the combined effects of wind and discharge. (Author's abstract)
W86-01328

LONG-TERM VARIATION OF [illegible] BENTHOS IN A MESOHALINE REG[illegible] CHESAPEAKE BAY,
Martin Marietta Environmental Systems[illegible] bia, MD.
A. F. Holland.
Estuaries, Vol. 8, No. 2A, p 93-113, Jun[illegible] Fig, 8 Tab, 50 Ref. Maryland Dept. o[illegible] Resources, Power Plant Siting Program[illegible] P46-83-02.

Descriptors: *Chesapeake Bay, *[illegible] *Benthos, *Population dynamics, Seaso[illegible] tion, Salinity, Estuaries, Marine ecosyste[illegible] temperature, Dissolved oxygen, Habitats.

The long-term variation of macrobentho[illegible] amined at the Calvert Cliffs (Maryland) [illegible] the Chesapeake Bay. Samples were ta[illegible] June 1971 to June 1982. Salinities ranged [illegible] 22 ppt over the 11 year study period. T[illegible] tinctive macrobenthic communities, th[illegible] sponded to the major sediment types [illegible] were found in all years: a nearshore sand[illegible] nity, a transitional muddy-sand commun[illegible] deep-water mud community. While th[illegible] composition of these communities was si[illegible] ative abundances of component specie[illegible] among them. Predictable seasonal cycles[illegible] ed for a relatively large (>20%) proport[illegible] total variation for populations that had [illegible] defined annual recruitment pulse. Predic[illegible] sonal cycles accounted for only a small[illegible] proportion of the variation for species[illegible] recruitment throughout the year or ape[illegible] Seasonal cycles did not account for mu[illegible] variation for species that had large yea[illegible] differences in abundance. Correlations be[illegible] linity and year to year abundance patte[illegible] frequently significant but accounted for [illegible] amounts of variation. Correlations betwe[illegible] year fluctuations in dissolved oxygen c[illegible] tion and abundances of dominant spe[illegible] always positive in the deep water mu[illegible] where they accounted for relatively large[illegible] of variation. Correlations between tempe[illegible] abundance of a few species were signific[illegible] ever, these correlations accounted for li[illegible] total abundance variation. Macrobenth[illegible] dances and temperature were more frequ[illegible] related for species living in the deep w[illegible] habitat than in shallow habitats. Diffe[illegible] summer dissolved oxygen concentration[illegible] year to year variation of macrobenthos i[illegible] water mud habitat, while salinity contro[illegible] year abundances in shallower habitats. [illegible] significant year to year differences were[illegible] the abundance of dominant species, the r[illegible] of the five most abundant species was n[illegible] across years and has remained similar for[illegible] decade. (Baker-IVI)
W86-01330

ABUNDANCE FLUCTUATIONS [illegible] BENTHIC INVERTEBRATES IN TWO[illegible] IC ESTUARIES,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field[illegible]
W86-01333

LONG-TERM ESTUARINE VARI[illegible] AND ASSOCIATION BIOLOGICA[illegible] SPONSE,
Texas Univ. at Austin, Port Aransas. M[illegible] ence Inst.
R. W. Flint.
Estuaries, Vol. 8, No. 2A, p 158-169, Ju[illegible] Fig, 2 Tab, 35 Ref.

Descriptors: *Corpus Christi Bay, [illegible] *Benthic environment, *Estuaries, Ec[illegible] Benthos, Cycling nutrients, Productivity[illegible] Salinity.

For the past 11 years, detailed data h[illegible] collected on benthic community structure[illegible] and secondary productivity, and sedimen[illegible] regeneration which are combined with o[illegible] mation, such as fishery yields, into a rec[illegible] long term data set for the Corpus Christi[illegible]

) the lowest salinity recorded was related to -term high intensity rainfall. Benthos re- d with abundance and biomass levels far than any other year. Large increases in yields were correlated with increased production. Primary, secondary, and tertiion production estimates derived from the ructed long-term data base indicated as a major link between primary producers her consumers. Nutrient recycling was to provide more than 90% of the nitrogen to support phytoplankton production and sidered a major factor influencing ecosysction. The matching of biological responses icant environmental changes in this estuary d insight into ecosystem function and the importance of short-term variability. ecycling was a major source of nutrients ng primary production, episodic environhanges from freshwater input provided a eeded stimulation to productivity. These changes replaced materials lost through g and sustained productivity over the long aker-IVI)
34

RS INFLUENCING THE SALINITY E OF LAKE PONTCHARTRAIN, ANA, A SHALLOW COASTAL N: ANALYSIS OF A LONG-TERM ET,
State Univ., Baton Rouge. Center for Resources.
ary bibliographic entry see Field 6G.
35

C NUTRIENT REMINERALIZATION ASTAL LAGOON ECOSYSTEM,
sland Univ., Narragansett. Graduate Oceanography.
vicki, and S. W. Nixon.
Vol. 8, No. 2B, p 182-190, June, 1985. 3 , 22 Ref.

rs: *Nutrients, *Coastal waters, *Lahode Island, *Potter Pond, Benthic envi- Mineralization, Ammonia, Nitrates, s, Sediments, Temperature effects, Light

ts of in situ light and dark chamber ents of benthic community nutrient flux Pond, a shallow coastal lagoon on the st of Rhode Island are presented. The mmonia, nitrate, phosphate and dissolved hosphorus exchange between the sedi- the overlying water were measured at mperatures and light levels, from differnt types, and were compared to similar nts reported for the deeper, heterotrom communities of nearby Narragansett ttempt was also made to calculate the benthic nutrient remineralization on the mistry of the lagoon and the potential n of regenerated nutrients to both d pelagic primary production. The remmonia from muddy sediments in dark anged from 20-440 micromol per sq m increased sharply with increase in tem- n the sandy tidal flat ammonia release significantly lower and showed no re- increasing temperature from 4 to 23 Ammonia release rates in correspondchambers were somewhat lower than ark chambers, though not statistically Nitrate fluxes in both light and dark were an order of magnitude lower than lease rates and were also erratic, show- t uptake and release, with no apparent with either temperature or light. Fluxes inorganic phosphate ranged from a net 0 to a net release of 50 micromol per sq n dark chambers and from -7 to 29 er sq m per h in light chambers. Phos- over mud-sediment areas rose sharply rature, while fluxes from the sandy tidal to fall below those for mud sediments no consistent response to temperature. mineralized phosphate in the lagoon is water column phosphate concentration olumn N/P ratios and suggests that the lagoon may show phosphate limitation rather than the nitrogen limitation commonly associated with marine systems. (Baker-IVI)
W86-01336

EUTROPHICATION AND MANAGEMENT INITIATIVES FOR THE CONTROL OF NUTRIENT INPUTS TO RHODE ISLAND COASTAL LAGOONS,
Rhode Island Univ., Narragansett. Graduate School of Oceanography.
For primary bibliographic entry see Field 5C.
W86-01337

TIDAL EXCHANGE BETWEEN A COASTAL LAGOON AND OFFSHORE WATERS,
Applied Science Associates, Inc., Wakefield, RI.
T. Isaji, and M. L. Spaulding.
Estuaries, Vol. 8, No. 2B, p 203-216, June, 1985. 11 Fig, 2 Tab, 23 Ref.

Descriptors: *Coastal waters, *Lagoons, *Tidal waters, Rhode Island, Charlestown Lagoon, Block Island Sound, Model studies, Finite element method, Hydrodynamics, Model studies.

The integration of a field observation program and hydrodynamic modeling studies are described. A better understanding of the pond circulation dynamics and exchanges of water with the ocean is derived through this integration. The Charlestown lagoon system, located on the southern coast of Rhode Island, consisting of two major basins, Ninigret Pond and Green Hill Pond, served as the study area. The pond system studied responds to first order in a simple pumping mode with the pond water levels rising and falling uniformly throughout in response to offshore forcing. At the semidiurnal tidal frequencies, where most of the energy is located, the sea level response factor is 0.18 with a high water phase shift of 2.5 hr. As the frequency of the forcing function decreases the response factor increases and the phase shift decreases until at periods greater than 4-5 days the water level variations in side and outside the pond are identical in phase and amplitude. The hydrodynamic model predictions for M2 tidal forcing, using the simple inlet hydraulics method of representing the system, are in good agreement with data and also compare well to measurements derived from lab experiments on a simple ocean-inlet bay system. While the geomagnetic electrokineograph (GEK) data provided reasonable estimates of the tidal currents in the breachway its low frequency response was particularly poor. The primary source of long term signal drift in GEK systems is that caused by variation of electrode temperature. A second significant drift source is the random variations which occur in the basic electrochemical potentials of the electrodes themselves. A third source is the telluric potentials which occur at both low and high frequencies. In extreme situations, continuous conductivity monitoring may be required. (Baker-IVI)
W86-01338

VARIABILITY OF DISSOLVED REACTIVE PHOSPHATE FLUX RATES IN NEARSHORE ESTUARINE SEDIMENTS: EFFECTS OF GROUNDWATER FLOW,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
C. F. Zimmermann, J. R. Montgomery, and P. R. Carlson.
Estuaries, Vol. 8, No. 2B, 228-236, June, 1985. 4 Fig, 4 Tab, 21 Ref.

Descriptors: *Estuarine environment, *Sediments, *Groundwater movement, *Phosphates, Seagrass, Seepage, Interstitial water, Tidal effects, Indian River, Florida.

Factors influencing the spatial and short term temporal variability inherent in seepage meter measurements and how these measurements relate to variations of selected pore water nutrient concentrations were investigated using the Indian River, a narrow estuarine lagoonal system extending approximately 182 km along the east coast of Florida as the study site. How much of the total flux for dissolved reactive phosphate can be attributed to seepage in nearshore estuarine sediments was determined. The extent of short term dilution effects on sediment pore water was measured. In situ samplers and seepage meters located in the grass beds yielded results very different from the control sampler and meter in the nongrass area of the study site. The variation in seepage velocities and DRP flux rates within a small area of nearshore sediment was closely linked with the heterogeneity of the system. Sediment size analysis of cores collected adjacent to the in situ samplers in the seagrass bed indicated the highest percentage of particles to be in the 150 micro-m range. A higher percentage of these particles was present in the area with no seagrass. The study indicates that the continual movement of groundwater from the sediments of nearshore estuarine areas and the inherent variability of the system is an extremely important factor when considering the total flux of nutrients in a specific area. The effect of the tide, in this case, was to alter the hydraulic gradient. The relationship between groundwater seepage velocity and dissolved reactive phosphate flux in nearshore sediments and its dependence on hydrogeological variables is important in determining nutrient flux budgets. The apparent relationship between tidal height and seepage velocities needs more careful examination and may be even more dramatic in areas with greater tidal ranges. (Baker-IVI)
W86-01339

IMPACT OF DISCHARGES FROM SEAFOOD PROCESSING ON SOUTHEASTERN ESTUARIES,
Georgia Univ., Brunswick. Marine Extension Service.
For primary bibliographic entry see Field 5C.
W86-01340

NUTRIENT ENRICHMENT OF ESTUARINE SUBMERSED VASCULAR PLANT COMMUNITIES. 1. ALGAL GROWTH AND EFFECTS ON PRODUCTION OF PLANTS AND ASSOCIATED COMMUNITIES,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
R. R. Twilley, W. M. Kemp, K. W. Staver, J. C. Stevenson, and W. R. Boynton.
Marine Ecology - Progress Series, Vol. 23, p 179-191, 1985. 8 Fig, 3 Tab, 62 Ref. EPA grants R805932020 and X003248010.

Descriptors: *Nutrients, *Estuarine environment, *Ponds, *Algal growth, Fertilization, Water pollution effects, Aquatic plants, Macrophytes, Solar radiation, Phytoplankton, Epiphytes.

Large experimental estuarine ponds were used to investigate the effects of nutrients on submersed vascular plant communities. The possibility that the decline in these plant communities as a result of fertilization can be explained in terms of increases in epiphytic algal and planktonic biomass which decrease the available light to leaves for macrophyte productivity was investigated. Seston and phytoplankton chlorophyll a increased with fertilization, and pronounced algal blooms were evident under high dosage. Of the total seston, phytoplankton exerted the greatest influence on attenuation of photosynthetically active radiation, such that there was insufficient light for submersed vascular plant growth at the sediment surface during blooms. An extensive epiphytic community developed on plants in all nutrient treated ponds at densities similar to those observed in nature on senescent plants. At high nutrient treatments the accumulation of epiphytic material resulted in over 80% attenuation of the incident radiation at the leaf surface. Biomass of submersed macrophytes decreased significantly under high and medium nutrient treatments compared to control and low treatments within 60 days following initial fertilization. Apparent production of vascular plants was reduced at the higher nutrient treatments. Most of this reduction was explained by attenuation of PAR associated with epiphytic material. Without PAR attenuance in the overlying water, observed levels of epiphytic growth would be insufficient to reduce light below compensation levels needed to

sustain vascular plant growth. At the high fertilization rates, integrated primary production of pond communities was significantly reduced with the loss of the vascular plants, even though phytoplankton and epiphytic growth were enhanced. (Baker-IVI)
W86-01351

PARTITIONING AND TRANSPORT OF METALS ACROSS THE O2/H2S INTERFACE IN A PERMANENTLY ANOXIC BASIN: FRAMVAREN FJORD, NORWAY,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 5B.
W86-01396

EFFECTS OF PH AND PLANT SOURCE ON LIGNOCELLULOSE BIODEGRADATION RATES IN TWO WETLAND ECOSYSTEMS, THE OKEFENOKEE SWAMP AND A GEORGIA SALT MARSH,
Georgia Univ., Athens. Dept. of Microbiology.
R. Benner, M. A. Moran, and R. E. Hodson.
Limnology and Oceanography, Vol. 30, No. 3, p 489-499, May, 1985. 4 Fig, 33 Ref. NSF grants OCE81-17834, BSR 81-14823, BSR 82-15587 and NOAA, Office of Sea Grant grant NA 80AA-D00091.

Descriptors: *Georgia, *Okefenokee Swamp, *Sapelo Island, *Salt marshes, *Wetlands, *Hydrogen ion concentration, *Lignocellulose, *Biodegradation, Lignin, Isotope studies, Sediments, Microorganisms.

The microbial mineralization of synthetic C-14 labeled lignin, specifically radiolabeled (C-14 lignin)-lignocellulose and (C-14 polysaccharide)-lignocellulose from a variety of aquatic herbaceous and woody plants was investigated in water and sediment from a salt marsh on Sapelo Island, Georgia, and from the Okefenokee Swamp, an acidic peat-forming freshwater swamp in southern Georgia. Rates of microbial degradation of lignocellulose were depressed in the Okefenokee relative to those in the salt marsh. About 50% of the difference in mineralization rates was attributable to the low ambient pH (3.9) of Okefenokee water relative to the pH of salt marsh water (pH 7.1). Rates of mineralization of the lignin component of lignocellulose were only minimally affected within the range of pH 4-8, whereas mineralization of the polysaccharide component increased severalfold with increasing pH. Differences in the biodegradability of the various lignocelluloses were also observed; lignocelluloses from herbaceous plants were mineralized several times faster than lignocellulose from wood. (Author's abstract)
W86-01413

NITROGENOUS NUTRIENT UPTAKE, PRIMARY PRODUCTION, AND SPECIES COMPOSITION OF PHYTOPLANKTON IN THE CARMANS RIVER ESTUARY, LONG ISLAND, NEW YORK,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
E. J. Carpenter, and S. Dunham.
Limnology and Oceanography, Vol. 30, No. 3, p 513-526, May, 1985. 16 Fig, 3 Tab, 26 Ref. NOAA Office of Marine Pollution Assessment grant NA 80-RAD0062, and NSF grant OCE 82-14764.

Descriptors: *Nitrogen, *Nutrients, *Primary production, *Species composition, *Phytoplankton, *Carmans River Estuary, *Long Island, *New York, *Estuarine environment, Ammonium, Nitrates, Urea, Cycling nutrients, Seasonal variation.

Uptake of NH4(+), NO3(-), and urea was measured at four stations in a small temperate-zone estuary over a 10-month period. Considering all four stations, NO3(-) accounted for 45% of all N taken up, followed by NH4(+) (43%) and urea (12%). Nitrogen uptake was highly temperature-dependent (r = 0.82), and an exponential relationship was apparent. Recycling was very important as a source of nitrogen, and mean NH4(+) pool turnover times were rapid, ranging from 4.3 to 6.8 h in the lower estuary in summer. PN turnover times in the lower estuary were also rapid, averaging 28.8 h in summer and being as short as 3.1 h in July and August. An analysis of N uptake using the relative preference index (RPI) indicated that NH4(+) was the preferred nutrient. However, high NO3(-) concentrations appeared to override the repressive effect of NH4(+) concentrations on nitrate reductase, and NO3(-)uptake was significant even at relatively high NH4(+) concentrations. Urea uptake did not appear to be affected by NH4(+) concentration. (Author's abstract)
W86-01415

DISTRIBUTION AND CHARACTERISTICS OF CARBOXYPEPTIDASE ACTIVITY IN POND, RIVER, AND SEAWATERS, IN THE VICINITY OF TOKYO,
Tokyo Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W86-01418

DEGRADATION AND MINERALIZATION OF THE POLYCYCLIC AROMATIC HYDROCARBONS ANTHRACENE AND NAPHTHALENE IN INTERTIDAL MARINE SEDIMENTS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W86-01481

DISTRIBUTION, ABUNDANCE, AND GROWTH OF JUVENILE DUNGENESS CRABS, CANCER MAGISTER, IN GRAYS HARBOR ESTUARY, WASHINGTON,
Washington Univ., Seattle. School of Fisheries.
B. G. Stevens, and D. A. Armstrong.
Fishery Bulletin, Vol. 82, No. 3, p 469-483, July, 1984. 9 Fig, 6 Tab, 23 Ref. Army Corps of Engineers contracts DACW-67-80-C-0086 and DACW-67-81-M-1096.

Descriptors: *Crabs, *Distribution, *Grays Harbor Estuary, *Washington, Immature growth stages, Migration, Habitats, Estuaries, Growth, Seasonal variation.

Dungeness crabs, Cancer magister, were collected biweekly or monthly from May 1980 to July 1981 in Grays Harbor, Washington. Age of each crab was estimated from width-frequency analyses, and the population density and growth rate were monitored for each age class over the 14-month period. In April 1980 and 1981, crabs entered the estuary either as megalops larvae that metamorphosed to first instar postlarvae or directly as first instars. Intertidal mudflats with beds of eelgrass (Zostera spp.) were important habitats for the first few postlarval stages. Some crabs may have emigrated from the estuary during their second year of life, whereas others dispersed throughout the estuary and appeared to emigrate at sexual maturity (about 2 years). No gravid females were ever found in the bay. Population size was estimated to range from 3.3 million crabs (winter) to 39.0 million crabs (summer); 74% of the summer population were early instars. Growth of early instars was rapid and resulted in a 282-fold increase in dry weight from May to September, but little growth occurred during the remainder of the year. Based on summer population abundance, it is estimated that this estuary could account for a substantial portion of recruitment to the offshore commercial fisheries. (Author's abstract)
W86-01496

MICROBIAL DEGRADATION OF THE LEACHABLE AND LIGNOCELLULOSIC COMPONENTS OF LEAVES AND WOOD FROM RHIZOPHORA MANGLE IN A TROPICAL MANGROVE SWAMP,
Georgia Univ., Athens. Dept. of Microbiology.
R. Benner, and R. E. Hodson.
Marine Ecology - Progress Series, Vol. 23, p 221-230, 1985. 6 Fig, 2 Tab, 28 Ref. NSF grant OCE-81117834 and Department of Commerce grant NA 80AA-D-00091.

Descriptors: *Mangroves, *Leaves, *Wood, *Microbial degradation, *Lignocellulose, Swamps, Tropical areas, Carbon radioisotopes, M
tion, Leachability, Polysaccharides, Detri
ments, Biodegradation.

Preparations of uniformly C-14 labeled n
leaves and specifically radiolabeled (C-1
lignocelluloses and (C-14 polysaccharide)
luloses from mangrove leaves and wood w
in experiments to determine the microbia
mineralization of the leachable and ligno
components of mangrove detritus in aer
anaerobic sediments of a tropical m
swamp. The bulk of the leachable fract
mangrove leaves was mineralized relative
ly and was assimilated into microbial bio
high efficiency (30%). In contrasts, rates
alization of the lignocellulosic componen
grove leaves and wood were 10-fold lo
mineralization rates or the leachable frac
polysaccharide component of the ligno
was mineralized at rates 2 times higher t
of mineralization of the lignin component
ing that mangrove detritus becomes rela
riched in lignin-derived carbon with time
bic rates of mineralization of the leach
lignocellulosic components of mangro
and wood were 10 to 30 times lower tha
tive aerobic mineralization rates, suggesti
long residence time for mangrove detritus
obic sediments. Comparison of the rates
dation of mangrove detritus in sediment
mangrove swamp and a salt marsh dem
that the lignocellulolytic potential in sed
the two marine ecosystems are similar,
lignocellulose from mangroves is less bi
ble than lignocellulose from the salt-mar
Spartina alterniflora and Juncus roemeria
thor's abstract)
W86-01503

**SETTING OF THE AMERICAN
CRASSOSTREA VIRGINICA IN THE
RIVER, VIRGINIA, USA: TEMPORA
SPATIAL DISTRIBUTION,**
Virginia Inst. of Marine Science, Glouces
D. S. Haven, and L. W. Fritz.
Marine Biology, Vol. 86, p 271-282, 1985
Tab, 33 Ref.

Descriptors: *Oysters, *Spatfall, *Tempo
bution, *Spatial distribution, *James Riv
ginia, Larvae, Estuarine environment, Wa
lation, Salinity, Stratification, Populatio
ics.

Setting of larvae of the oyster Crassostr
ica was monitored in the James River,
from 1963 to 1980. Setting patterns were
two ways to those described prior to 196
the onset of the oyster pathogen Haplos
nelsoni (MSX) in Chesapeake Bay): (
intensity (average number of spat per s
greater at stations in the lower than uppe
and (2) on the average, 60 to 80% of
annual set at each station occurred during
period from mid-August through S
However, annual setting intensity from
was lower than previously recorded, a
sets occurred as a series of discrete puls
than continuously throughout the seaso
were each approximately 1 to 2 weeks in
and separated by a period of diminish
setting. Cross-correlation analysis of annu
patterns among stations revealed three zo
James River: the upper estuary and ent
west side, the lower estuary, and a mi
transition zone. Setting pulses tended to
chronous at stations within each zone,
curred 1 to 2 weeks later at stations in d
than in upriver zones. The location of
related to known aspects of water circu
the James River estuary. Moreover, pul
itself may be related to the absence
vertical salinity gradients accompanying
nightly stratification-destratification proc
thor's abstract)
W86-01504

**WATER QUALITY IN AN ESTUARIN
RONMENT: ANNUAL CYCLE OF THE**

AND CHEMICAL PARAMETERS OF THE ER OF THE LOIRE ESTUARY (QUALITE EAUX EN MILIEU ESTUARIEN: SUIVI UEL DE CRITERES PHYSIQUES ET CHI-UES DANS LES EAUX DE L'ESTUAIRE A LOIRE),
s Univ. (France). Lab. de Biologie Marine.
ce, J.-F. Guillaud, and B. Gallenne.
biologia, Vol. 124, No. 3, p 199-210, May, 1 Fig, 2 Tab, 30 Ref.

ptors: *Estuarine environment, *Water qual-oire estuary, *France, River flow, Chemical sition, Nutrients, Dissolved oxygen, Sus-l solids, Turbidity, Nitrogen, Phosphorus,

cal composition and physical parameters of from the Loire estuary were examined in 982 in order to assess water quality. It ap-hat riverflow is of first importance on sus-matter load, dissolved nutrient concentra-nd oxygenation. The annual hydrological made of two periods. During the first one erflow, low nutrient concentrations, high ed matter load and oxygen depletion are During the second one higher riverflows ccompanied with increasing nutrient con-ons, decreasing turbidity and restoration of d oxygen. Results indicate that annual f dissolved nutrients attain 60 000 t/a for , 2 400 t/a for for phosphorus and 100 000 ilica. It is suggested that the high suspend-er loading (1 million t/a) is a significant isturbing oxygenation and by the way lim-ter quality within the estuary. (Author's
505

ANKTON ABUNDANCE DISTRIBU-OF A MEDITERRANEAN LAGOON STEM: THE SARRAZINE LAGOON BUTIONS D'ABONDANCES DU ZOO-TON D'UN ECOSYSTEME LAGUN-EDITERRANEEN: LA LAGUNE DE LA ZINE),
lier-2 Univ. (France). Lab. d'Hydrobiolo-ne.
ai, M. Amanieu, and G. Lasserre.
ologica, Vol. 5, No. 3, p 301-315, 1984. 5 b, 14 Ref.

ors: *Lagoons, *Zooplankton, *Abun-istribution, Mediterranean, Ecosystems, udies, Coastal lagoons, Distribution.

of zooplankton abundance distributions carried out from October 1980 to October lagoon artificially managed for aquacul-the north-western Mediterranean coast. r body, supplied with sea-water by pump, red as an open ecosystem. This is particu-wn by population profiles close to the posed by the Preston and Mandelbrot abundance distribution. The Motomura evails whenever the lagoon environment ubject to more severe conditions or the ent from the near-by sea is intensifying. neters of the models of abundance distri-oted above have been studied as synthetic s of the organization of existing commu-thor's abstract)
1

N THE DETERMINATION OF VERTI-RBULENT TRANSPORT COEFFI-N A PARTIALLY MIXED ESTUARY,
m Univ. (England). Dept. of Civil Engi-

D. W. Knight, and K. Shiono.
gs of the Institution of Civil Engineers, 235-246, June, 1985. 6 Fig, 1 Tab, 15

s: *Turbulence, *Estuaries, Velocity, ixing, Mathematical equations, Vertical Great Ouse estuary, England.

e measurements of two components of nd of salinity have been made in the e estuary (England) for partially mixed conditions. The data have been used to investigate the dependence on Richardson number of several coefficients associated with the turbulence closure problem. Empirical equations are presented for the variation of the mixing lengths for momentum and solute with Richardson number for the observed conditions. A limited number of evaluations of the turbulence coefficients associated with the flux terms uw (mean) and sw (mean) gave values which were of the same order as those assumed by other workers for neutrally stable conditions. The field measurement techniques have been shown to be feasible and to yield useful results. More measurements are required over a wider range of conditions in order to substantiate these preliminary findings. (Author's abstract)
W86-01517

DISTRIBUTION AND FLUX OF 226RA AND 228RA IN THE AMAZON RIVER ESTUARY,
Princeton Univ., NJ. Geophysical Fluid Dynamics Program.
R. M. Key, R. F. Stallard, W. S. Moore, and J. L. Sarmiento.
Journal of Geophysical Research, Vol. 90, No. C4, p 6995-7004, July, 1985. 6 Fig, 5 Tab, 32 Ref.

Descriptors: *Radium radioisotopes, *Isotope studies, *Amazon River estuary, *Estuarine environment, Suspended particulates, Mixing, Sediments, Geochemistry, Water chemistry.

Measurements of Ra-226 and Ra-228 in the Amazon River estuary show that desorption from river-borne suspended particulate matter in the estuary increases the riverine flux of both isotopes to the ocean by a factor of approximately 5 over the flux attributable to radium dissolved in the river water alone. The total Amazon flux supplies approximately 0.20% of the Ra-226 and approximately 2.6% of the Ra-228 standing crops in the near-surface Atlantic (0-200 m). Diffusive flux from estuarine and shelf sediments and desorption from resuspended sediments in the region of the estuary approximately double the estuarine Ra-226 concentration and quadruple the estuarine Ra-228 concentration above that caused by the dissolved and desorbed river components alone. (Author's abstract)
W86-01535

EXCHANGE OF WATER IN FJORDS: THE EFFLUX/REFLUX THEORY OF ADVECTIVE REACHES SEPARATED BY MIXING ZONES,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
E. D. Cokelet, and R. J. Stewart.
Journal of Geophysical Research, Vol. 90, No. C4, p 7287-7306, July, 1985. 13 Fig, 1 Tab, 19 Ref.

Descriptors: *Fjords, *Mixing, *Advection, Stratification, Salinity, Saline-freshwater interface, Coastal waters, Path of pollutants.

Many fjords consist of deep, stratified reaches separated by shallower sills above which most of the mixing between water masses occurs. On a long time scale, each reach can be modeled as a steady, two-layer advective flow. These flows intermingle in turbulent mixing zones, where the flow from any incoming layer can be split into two parts: an efflux fraction, which continues on into the next reach, and a reflux fraction, which mixes vertically and recirculates into its original reach. These fractions were defined using conservation of mass, and expressed in terms of the salinities observed in the reaches. The processes of the complex mixing zones need not be considered in detail. These ideas are applicable to complicated branched fjords and linked sequences of reaches. Where more than two reaches meet at a multiple junction the conservation of two tracers (usually fresh water and salt) is insufficient to determine completely the efflux/reflux fractions. We propose an entropy maximization technique to resolve the uncertainty. Long-term pollutant concentrations relate directly to the circulation via the new efflux/reflux formulation. The method demonstrates that refluxing leads to conservative pollutants being broadcast throughout the fjord system with magnified concentrations. A new quantity, the mean tracer age, provides a relevant time scale that includes the effects of recirculation and to which the rates of nonconservative processes should be compared. Conservative pollutants may be retained for a surprisingly long time in a refluxing system. (Author's abstract)
W86-01536

SEDIMENT ACCUMULATION RATES IN IRONDEQUOIT BAY, NEW YORK BASED ON LEAD-210 AND CESIUM-137 GEOCHRONOLOGY,
Geological Survey, San Diego, CA. Water Resources Div.
R. A. Schroeder.
Northeastern Environmental Science, Vol. 4, No. 1, p 23-29, 1985. 4 Fig, 3 Tab, 5 Ref.

Descriptors: *Sedimentation, *Irondequoit Bay, *New York, *Lead radioisotopes, *Cesium radioisotopes, Stratigraphy, Particle size, Erosion, Copper, Zinc, Metals, Estuarine environment.

Recent sediment accumulation rates in Irondequoit Bay, determined by the lead-210 and cesium-137 techniques, range from 0.10 to 0.36 grams per square centimeter per year. The lowest rate is in Ides Cove, a small inlet on the west side of the bay. On the basis of these rates, it is presumed that sediment below a depth of about 1 meter was deposited before European colonization of the basin in the early 1800's. Average flux of lead-210 in the core from Ides Cove, calculated from lead-210 inventories in the core, equals the published atmospheric deposition rate (from measurements in New Haven, Connecticut); but, the average flux of lead-210 is two to three times higher in the cores from the central parts of Irondequoit Bay. The higher flux is most likely caused by preferential scavenging (sediment focusing) on fine-grained sediments. However, direct input of lead-210 attached to eroding material in the watershed is possible. Concentrations of lead, copper and zinc in the sediments show a marked increase beginning about 50 years ago. As in many other areas, this increase is most likely caused by human activities. The increment over natural background levels is a factor of about 14 for lead, 5 for copper, and 4 for zinc. These ratios are much larger than in many water bodies because urbanization covers a comparatively large proportion of this watershed. (Author's abstract)
W86-01566

METHOD FOR MEASURING HORIZONTAL TRANSPORT OF ORGANIC CARBON OVER SEDIMENTS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
For primary bibliographic entry see Field 2H.
W86-01590

SHORT-TERM ENDPRODUCTS OF SULFATE REDUCTION IN A SALT MARSH: FORMATION OF ACID VOLATILE SULFIDES, ELEMENTAL SULFUR, AND PYRITE,
Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.
G. M. King, B. L. Howes, and J. W. H. Dacey.
Geochimica et Cosmochimica Acta, Vol. 49, No. 7, p 1561-1566, July, 1985. 4 Fig, 1 Tab, 39 Ref.

Descriptors: *Sulfate reduction, *Salt marshes, Sulfides, Sulfur, Pyrite, Oxygen, Carbon dioxide, Metabolism, Marshes, Dissolved solids, Volatile compounds, Wetlands.

Rates of sulfate reduction, oxygen uptake and carbon dioxide production in sediments from a short Spartina alterniflora zone of Great Sippewissett Marsh were measured simultaneously during late summer. Surface sediments (0-2 cm) were dominated by aerobic metabolism which accounted for about 45% of the total carbon dioxide production over 0-15 cm. Rates of sulfate reduction agreed well with rates of total carbon dioxide production below 2 cm depth indicating that sulfate reduction was the primary pathway for subsurface carbon metabolism. Sulfate reduction rates

were determined using a radiotracer technique coupled with a chromous chloride digestion and carbon disulfide extraction of the sediment to determine the extent of formation of radiolabelled elemental sulfur and pyrite during short-term (48 hr) incubations. In the surface 10 cm of the marsh sediments investigated, about 50% of the reduced radiosulfur was recovered as dissolved or acid volatile sulfides, 37% as carbon disulfide extractable sulfur, and only about 13% was recovered in a fraction operationally defined as pyrite. Correlations between the extent of sulfate depletion in the marsh sediments and the concentrations of dissolved and acid volatile sulfides supported the results of the radiotracer work. The data suggest that sulfides and elemental sulfur may be major short-term end-products of sulfate reduction in salt marshes. (Author's abstract)
W86-01614

DEVELOPMENT OF A TREED BOG ISLAND IN A MINEROTROPHIC FEN,
Northern Forest Research Centre, Edmonton (Alberta).
S. C. Zoltai, and J. D. Johnson.
Canadian Journal of Botany, Vol. 63, No. 6, p 1076-1085, June, 1985. 5 Fig, 5 Tab, 24 Ref.

Descriptors: *Bogs, *Fens, *Alberta, Vegetation, Nutrients, Calcium, Magnesium, Sulfur, Peat, Trophic level, Trees, Wetlands, Ecology.

Bogs are acid and extremely low in mineral nutrients, while fens are less acidic and more nutrient rich. The development of a heavily treed bog island situated in a wooded fen was studied. The study site itself is a treed bog island, about 0.5 ha in size, situated some 150 m from the edge of a large, 1.2 km wide fen complex in Alberta. An oligotrophic peat layer exists over a mineral-enriched base on the treed island, which supports a predominantly bog vegetation. Macrofossils indicate that the central part of the island has supported oligotrophic treed bog vegetation almost since the beginning of its formation. Three volcanic ash layers allow the reconstruction of the position of the wetland surface at different times. The treed island was initiated on a slight rise and it was always slightly higher than the surrounding fen, maintaining oligotrophic conditions above the fen level. On the treed island, the peat above the fen level is low in such nutrients as calcium, magnesium, and sulfur, but below the fen level the chemical characteristics of the peat are similar to those of the fen peat. Plant remains indicate that conditions have been relatively stable both on the treed island and in the fen; the only major change has been caused by the lateral expansion of the treed island. (Moore-IVI)
W86-01630

DISPERSAL PATHWAYS FOR PARTICLE-ASSOCIATED POLLUTANTS,
Exxon Production Research Co., Houston, TX.
For primary bibliographic entry see Field 5B.
W86-01677

INVESTIGATION OF A EUTROPHIC TIDAL BASIN: PART 2 - NUTRIENTS AND ENVIRONMENTAL ASPECTS,
Southern Water Authority, Otterbourne (England). Resources Planning Lab.
For primary bibliographic entry see Field 5C.
W86-01789

SULFIDE CONTROL OF CADMIUM AND COPPER CONCENTRATIONS IN ANAEROBIC ESTUARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-01800

EFFECT OF SEAWATER MAGNESIUM ON NATURAL FLUORESCENCE DURING ESTUARINE MIXING, AND IMPLICATIONS FOR TRACER APPLICATIONS,
North Carolina Univ. at Wilmington. Div. of Chemistry.
J. D. Willey.
Marine Chemistry, Vol. 15, No. 1, p 19-45, 1984. 10 Fig, 7 Tab, 43 Ref.

Descriptors: *Seawater, *Magnesium, *Fluorescence, *Estuarine environment, *Mixing, *Tracers, Environmental tracers, Humic compounds, Fulvic compounds, Metals, Copper, Iron, Calcium, Salinity.

Natural fluorescence, which is thought to result from low molecular weight humic and fulvic compounds, can be used as a tracer to distinguish between individual river waters. Natural fluorescence exhibits conservative mixing with seawater, except for a slight fluorescence increase which is sometimes observed in the low salinity range (0-5%). This increase is not due to the inner filter effect (internal quenching). Laboratory experiments can reproduce this low-salinity natural fluorescence increase. Of the major seawater ions, only magnesium can cause a similar natural fluorescence increase. Variation in sample pH, ionic strength, or particle content cannot explain the natural fluorescence increase, nor does it appear to be related to the estuarine flocculation of humic material. Addition of seawater magnesium to the fluorescent material with subsequent loss of hydrogen ions could enhance fluorescence by adding crosslinking to the structure. Replacement of a fluorescence-depressing metal like copper or iron by magnesium could also enhance fluorescence, essentially by removing the quenching effect of the metal. Experimental data in this study are consistent with both of these possible mechanisms. Calcium also enhances fluorescence, however the effect of seawater calcium during estuarine mixing is not as apparent as the magnesium effect. The implications of this low-salinity natural fluorescence increase with respect to estuarine and coastal tracer applications depend on whether individual rivers mix in the high or low salinity region of an estuary or coastal area. (Author's abstract)
W86-01801

ORGANIC MATTER IN THE VOLGA DELTA AND DELTA FRONT,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
M. P. Maksimova, and M. P. Metreveli.
Water Resources, Vol. 11, No. 4, p 352-360, July-August, 1984. 1 Fig, 2 Tab, 12 Ref. Translated from Vodnye Resursy, No. 4, p 100-109, July-August, 1984.

Descriptors: *Volga Delta, *USSR, *Organic matter, Estuarine environment, Rivers, Chemical compounds, River flow, Seasonal variation, Deltas, Runoff, Caspian Sea.

The concentration and biochemical composition of organic matter in river waters entering the Volga upper delta, delta front, and North Caspian are not identical. The zonal differences are due to the intensity and direction of a number of in situ processes specific for various delta zones. The degree and character of zonal differences of organic matter vary seasonally and also depend on the hydrologic characteristics of the year. Physical processes of erosion of organic matter from soils are most characteristic for the upper zones of the western and eastern parts of the delta, especially in the flood period. Decompositional processes are most pronounced in the lower reach of the delta as a result of a decrease of current speeds. The maximum concentrations of organic matter in delta waters are characteristics for the summer low-flow period; slightly lower concentrations are observed in the fall and the minimum in the winter. In an annual aspect processes leading to enrichment of waters in organic matter dominate in the aggregate of differently directed physical, chemical, and biological processes occurring in the Volga delta and delta front. However, enrichment of river waters of continental runoff inorganic matter in the delta does not lead to an increase of organic runoff to the North Caspian, since a considerable part of the organic matter is deposited in the lower reach. As a result of transformation in the delta, the organic continental runoff undergoes qualitative changes: the organic matter entering the North Caspian is somewhat richer in the nitrogen componen
pared with the organic matter of waters e
the upper delta. (Baker-IVI)
W86-01810

**LAW OF THE COAST IN A CLAMS
PART X: THE NORTH CAROLINA
PROACH,**
California Dept. of Justice, San Francisco.
of the Attorney General.
P. H. F. Graber.
Shore and Beach, Vol. 51, No. 1, p 18-23, Ja
1983. 2 Fig, 76 Ref.

Descriptors: *Coastal waters, *Erosion,
Carolina, *Legal aspects, Public rights,
rights, Erosion control, Coastal zone manag

In 1978 the North Carolina Coastal Mana
Program became the South's first federal
proved coastal plan, and in 1981 an ex
Beach Access Program was initiated. The
lands of the state may be divided into three
ries, uplands, tidelands, and submerged la
common with most coastal states, North C
has adopted a high water legal boundary b
uplands and tidelands. In general the state
the usual rule that both accretion and erosio
changes in the upand/tideland boundary.
Carolina's Supreme Court was one of the
tribunals to articulate what is now term
public trust doctrine. In 1981 North Ca
legislators created the Coastal Beach Acce
gram to acquire, improve and maintain p
along the Atlantic Ocean for a system of
access to ocean beaches. In addition to the
natural accretion private littoral owners in
Carolina enjoy a qualified right of access
adjoining navigable waters. Leasing and reg
of coastal zone lands and waters are brie
cussed. (Baker-IVI)
W86-01833

**BASIC PRINCIPLES OF SEDIMENT BU
STUDY IN THE COASTAL ZONE,**
Odesskii Gosudarstvennyi Univ. (USSR).
Y. D. Shuisky, and M. L. Schwartz.
Shore and Beach, Vol. 51, No. 1, p 34-40, J
1983. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Coastal waters, *Sedimentatio
sion, Beaches, Sediment budget, Mathe
equations, Geomorphology.

Methods are presented which make it pos
calculate a sediment budget for the coastal
any body of water. For that purpose the
zone should be broken down into element
systems (longshore cells). Then one must c
the numerical values of those budget e
which are identified when compiling the
nary list of elements. Following this, corr
ing elements from each of the subsyste
summed up: erosional with erosional, bi
with biogenous, fluvial with fluvial, etc
result, numerical values of the budget elem
the coast as a whole can be obtained.
present day stage of coastal geomorpholo
merical data are not available to construct
equation for the entire coast of the world.
er, it is now possible to develop such a s
budget for large regions of the better-studie
al zones. (Baker-IVI)
W86-01834

**ECONOMIC AND CULTURAL
QUENCES OF LAND LOSS IN LOU
Nicholls State Univ., Thibodaux, LA.
Earth Science.
For primary bibliographic entry see Fi
W86-01835

**LAW OF THE COAST IN A CLAM
PART XV: THE SOUTH CAROLIN
PROACH,**
P. H. F. Graber.
Shore and Beach, Vol. 52, No. 2, p 18-2
1984. 1 Fig, 98 Ref.

iptors: *Coastal waters, *Legal aspects, h Carolina, Public access, Public rights, En- nental protection, Public trust doctrine, al zone management.

South Carolina Coastal Management Pro- based on the state's 1977 Coastal Zone Man- nt Act articulates ambitious goals and objec- or this valuable zone which includes a 1,241 horeline. Traditionally South Carolina law cognized that the legal boundary between e uplands and adjoining sovereign tidal- l lands is subject to fluctuation as a result of on and erosion, which is consistent with the common-law rule. A provision in the state's management law purports to alter that rule espect to owernship of accreted land. The trust doctrine has not been clearly and ively applied by South Carolina courts, but y cases the courts have indicated that tidal lands are held in trust for the public. South a has historically not encouraged public to the seashore, nor have the state's courts ed coastal access by invoking such legal es as implied dedication and custom, which en used by other jurisdictions. Private land- along South Carolina's coast still enjoy traditional littoral rights, but some con- recently have been imposed under the coastal management law and program. The management program discourages private owners from developing and keeping cer- es of impoundments, such as wetland areas ff from adjacent tidal rivers and estuaries. Carolina's coastal zone leasing activities are ly limited when compared with those of ates, although there are a number of oyster ion and phosphate mining leases. (Baker-

836

REHENSIVE STUDY OF THE COAST LIFORNIA,
ngineer District, Los Angeles, CA.
in.
nd Beach, Vol. 52, No.2, p 31-35, April, Fig.

ors: *Coastal waters, *California, *Envi- al protection, Water management, Plan- edimentation, Sediment transport, Wind, low, Aerial photography, Precipitation,

on of future changes, whether natural or nduced, is the ultimate goal of scientific This prediction capability allows planners ineers to allocate valuable natural re- such as scenic coastal bluffs and sandy to uses and functions which will maximize efits to society, and minimize the harmful d environmental effects of such alloca- ie to the concern in recent years of the s slow, but always consistent erosion of ornia coastline, research by public agen- vate industry, research corporations, and al institutions has intensified. Although rts contribute greatly to the planning and ng efforts of local areas or circumscribed comprehensive planning for coastal as seldom taken place. The effect of a evelopment on the upcoast or downcoast is seldom realized until that effect be- problem. Coastal development pressures inue into the next century and beyond. equacy of our knowledge of why shore- , why harbors shoal, and when lagoons ch their barriers to the sea must be ac- ed and the need for a comprehensive, all sing coastal processes study must be ad- The Section 208 authority addresses the udy floods aggravated by or due to wind effects. The Plan of Study outlines the e undertaken so the effects of wind and es can be understood and thus the poten- conomic growth and the preservation of d wildlife resources will not be dimin- st in the future. (Baker-IVI)
7

THE COAST IN A CLAMSHELL; I: THE MAINE APPROACH,
P. H. F. Graber.
Shore and Beach, Vol. 52, No. 3, p 17-20, July, 1984. 59 Ref.

Descriptors: *Maine, *Coastal waters, *Legal aspects, Environmental protection, Tidal lands, Public access, Public rights, Public trust doctrine.

As a result of Maine's adherence to the colonial ordinance of 1647, the property boundary between public and private lands within the state's coastal zone is generally the low-water line. The littoral owner of the upland parcel prima facie owns the adjoining tidelands. Maine, like Massachusetts, is among the minority of coastal states in which the low water line generally demarcates public and private ownership in tideflowed lands. Presumably, Maine accepts the traditional common law concepts that property boundaries along the coast change when there is accretion or erosion. Compared with many other coastal states, public access to the shoreline is somewhat restricted in Maine because the vast majority of the tidelands are privately held. Private upland owners in Maine are legally presumed to have the right of access to the ocean along their entire frontage. The director of the state Bureau of Public Lands may lease state-owned tide and submerged lands for statutorily designated purposes, including dredging, filling, or other needs. Submerged lands may be leased for aquaculture or scientific research. A number of statutes regulate activities in the coastal zone. (Baker-IVI)
W86-01838

LAW OF THE COAST IN A CLAMSHELL; PART XVII: THE CONNECTICUT APPROACH,
P. H. F. Graber.
Shore and Beach, Vol. 51, No. 4, p 15-18, October, 1984. 56 Ref.

Descriptors: *Connecticut, *Coastal waters, *Legal aspects, Water management, Environmental protection, Water rights, Public access, Public rights, Public trust doctrine, Planning, Beaches.

Under the Connecticut Coastal Management Program, the state's coastal area stretches seaward to the limit of state jurisdiction in Long Island Sound. The program utilizes a two-tier approach. The first extends only a short distance landward from the shoreline, while the second tier is bounded by the inland limits of 36 coastal municipalities. The high water mark divides the private uplands from the public tidelands. The upland owner is in general entitled to the benefit of gradual accretion to his property. The public trust doctrine has been judicially recognized but apparently not widely applied in Connecticut. Instead, the state has relied on its regulatory authority under the police power to protect public rights. Beaches are a limited resource in Connecticut. Most of the uplands adjoining these beaches are owned by private parties or by beach associations that usually restrict access to the water across their uplands to residents or association members. The right of access to adjoining navigable waters is the fundamental littoral right of upland owners in Connecticut. The state commissioner of agriculture may lease certain areas for the purpose of planting and cultivating shellfish. Although some restrictions on the use of tidal lands and waters had been imposed earlier, Connecticut's most sweeping legislation in this field has occurred during the past quarter century. These regulatory programs reach beyond the control of navigation and encompass environmental and other concerns. (Baker-IVI)
W86-01840

TARAVAL VERTICAL SEA WALL,
San Francisco City, CA.
P. D. Berrigan.
Shore and Beach, Vol. 53, No. 1, p 3-7, January, 1985. 9 Fig, 5 Ref.

Descriptors: *Beaches, *Erosion control, *Seawalls, *California, *San Francisco, Ocean Beach, Erosion, Sediment transport.

There is a serious beach erosion problem at Ocean Beach, San Francisco in the reach between Noriega and Santiago Streets. The problem will not be solved by beach nourishment alone, but can be solved by extending the Taraval Sea Wall to Noriega Street. The Taraval Sea Wall was originally built in 1941 to protect the Great Highway along Ocean Beach. The area is now part of the Golden Gate National Recreation Area, and is also the site of the construction of the Westside Transport, a large sewer for wet weather flow. If the National Park Service will not alter its policy of No Structures on Beaches, it should return to the city the needed strip of duneland which the city donated to the Park Service, in order that the City can have and maintain, at reasonable cost, a proper beach and highway and have control of the area where planting and fences for abatement of blowing sand can be constructed and maintained. (Baker-IVI)
W86-01841

LAW OF THE COAST IN A CLAMSHELL; PART XVIII: THE VIRGINIA APPROACH,
P. H. F. Graber.
Shore and Beach, Vol. 53, No.1, p 8-14, January, 1985. 97 Ref.

Descriptors: *Legal aspects, *Virginia, *Coastal waters, Public access, Public rights, Public trust doctrine, Water mangement, Water resources development.

Along Virginia's Atlantic coast, many stretches of the uplands immediately adjoining the shoreline are publicly owned. Under a Virginia statute enacted in 1819, the titles of private landowners of uplands adjoining tidewater were generally extended down to the low water mark. The low water mark as the principal property boundary separating private and public lands, shifts with gradual, imperceptible accretion and erosion. In Virginia, an argument might be made that a provision of the conservation of natural resources, added to the state Constitution in 1971, would support a broader application of this doctrine by the commonwealth's courts. In the 1982 decision involving Hog Island's beaches and marshes the commons concept was favored as a means of protecting public rights. In addition to enjoying the benefit of accretion to their property, private owners of land adjoining tidal waters in Virginia have a number of other rights. The commonwealth's Marine Resources Commission, subject to statutory limitation, is empowered to lease the beds of certain state-owned waters for the prospecting for and removal of oil, gas and other minerals. Coastal zone lands and waters are regulated under three principal statutory schemes: the subaqueous lands management program, the Wetlands Act and the Coastal Primary Sand Dune Protection Act. (Baker-IVI)
W86-01842

INLETS AND BARRIER BEACH DYNAMICS: A CASE STUDY OF SHINNECOCK INLET, NEW YORK,
Patchogue, New York.
J. Kassner, and J. A. Black.
Shore and Beach, Vol. 51, No. 2, p 22-26, April, 1983. 5 Fig, 1 Tab, 9 Ref.

Descriptors: *New York, *Shinnecock Inlet, *Beach stabilization, Inlets, Stabilization, Erosion control, Beach erosion, Groins, Sediment transport.

The history of Shinnecock Inlet, its role in coastal processes and the consequences of efforts to stabilize it are reviewed. The dredging and stabilization of the inlet at Shinnecock appear to be the major factors involved in the accelerated erosion of the barrier beach to the west of the inlet. This erosion was exacerbated by the construction of the mid-beach groin field and the failure to backfill the groins to maintain the longshore transport of sediment. This flaw in implementation then led to the construction of additional groins to the west which merely displaced the problem further west. Ironically it appears that the entire beach stabilization project, begun in 1965, may have been unnecessary. By that time, Shinnecock Inlet had entered Period IV and sediment was being naturally by-

passed to the west. The accelerated erosion of the 1950s was therefore significantly reduced. The construction of the groins to address the initial erosion problem caused by the stabilization of the inlet created several others. The history of Shinneock Inlet illustrates the need for comprehensive barrier beach planning and management. Finally, it must be realized that there are no shortcuts in beach stabilization. (Baker-IVI)
W86-01843

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

VISCOELASTIC MODEL FOR INITIAL FLUX DECLINE THROUGH REVERSE OSMOSIS MEMBRANE,
Tohoku Univ., Sendai (Japan). Faculty of Engineering.
Y. Kurokawa, M. Kurashige, and N. Yui.
Desalination, Vol. 52, No. 1, p 9-14, December, 1984. 3 Fig, 10 Ref.

Descriptors: *Reverse osmosis, *Desalination, *Model studies, Flow, Membrane processes, Fluctuations.

Asymmetric cellulose acetate reverse osmosis (RO) membranes exhibit a decline in water flux when operated under RO performance. Especially under the high pressure necessary to desalinate seawater, the membrane creeps and compacts. A homogeneous membrane was prepared from a cellulose acetate butylate (CAB) acetone cast solution. Compression test of the membrane was carried out in such a way that the membrane could be inserted and pressurized mechanically between two cylindrical rods by an electric servohydraulic universal testing machine. RO experiment was performed by using a continuous flow type apparatus. The flux decline through a reverse osmosis membrane is described by assuming that the membrane behaves as a viscoelastic body composed of three elements. This model can be used to predict the flux decline with time for the RO membrane. (Baker-IVI)
W86-01367

EFFECTS OF ACCELERATION ON SPIRAL-WOUND MEMBRANE PERFORMANCE IN REVERSE OSMOSIS,
SRI International, Menlo Park, CA. Engineering Sciences Lab.
J. C. Eid, and G. B. Andeen.
Desalination, Vol. 52, No. 1, p 15-24, December, 1984. 6 Fig, 9 Ref.

Descriptors: *Reverse osmosis, *Desalination, *Buoyance, *Acceleration, Membrane processes, Centrifugation.

Buoyance in reverse osmosis has been considered by several investigators as a means of increasing the flow of contaminants from the membrane surface to reduce fouling and concentration polarization. Buoyance effects arise from the presence of enriched, and thus higher density brine near the membrane, and an acceleration field. An acceleration field placed over a density gradient results in a pressure gradient, which - given proper orientation - leads to a flow. By placing the increasing density gradient in a membrane system in the same direction as the vector of positive acceleration, the flow of contaminants from the membrane surface can be increased. Experimental data show that acceleration, applied to spiral-wound reverse osmosis membranes by centrifugation, increases membrane performance. The effects of acceleration on concentration polarization were determined by testing spiral-wound membranes under accelerations up to 500 x g with 0.5% sodium chloride. The data indicate a reduction in salt concentration at the membrane surface from 2.2 to 1.0% from a nonaccelerated state when 500 x g acceleration is applied to a properly oriented membrane. This reduces the osmotic pressures at the membrane and increases permeate recovery by 21%. (Baker-IVI)
W86-01368

INHIBITION OF CALCIUM SULFATE DEPOSITIONS BY A FLUIDIZED BED,
Akzo Chemie Nederland B.V., Deventer.
J. A. M. Meijer.
Desalination, Vol. 52, No. 1, p 25-42, December, 1984. 15 Fig, 15 Ref.

Descriptors: *Scale, *Fluidized beds, *Desalination, *Calcium sulfate, Seawater, Salts, Temperature effects, Evaporators.

To investigate the influence of the fluidized bed on the deposition of calcium sulfate and to determine the top operational temperature, a test unit with four full-size heat exchanger tubes was built. In these tubes the same mean porosities, the same particles, the same liquid velocities and a comparable heat flux were applied as in an actual multistage flash/fluidized bed evaporator design. Since the attention was mainly focused on the formation of calcium sulfate scale in seawater solutions, the experiments were performed with a brine consisting of calcium, sulfate, magnesium, sodium and chloride ions in water in the same ratio as in standard seawater. In these experiments the top temperature was determined as a function of the following parameters: concentration factor of the brine, exclusion or recirculation of seed crystals, degassing or aeration of the brine, and tube diameter and diameter of the fluidized bed glass particles. In addition, the modification of the deposited calcium sulfate crystals forming the scale layer was examined, as well as the habit of the crystals situated either close to the heat transfer surface or at a certain distance from this surface. In all experiments deposition on the tube walls was prevented as long as the hemihydrate solubility line was not exceeded, yielding a practical procedure to assure scale-free operation of a multi-stage flash/fluidized bed evaporator. The scale layers deposited at temperatures above the hemihydrate line consisted initially of stellated conglomerates of hemihydrate crystals, which frequently seemed to be mixed with substantial amounts of gypsum. This initially formed layer was replaced by an anhydrite layer at a rate enhanced by increasing temperatures and decreasing pH values. (Baker-IVI)
W86-01369

FLOCCULATION, PRECIPITATION, SEDIMENTATION AND FLOTATION FOR USE AS PRETREATMENT STAGES FOR BRACKISH WATER AND SEAWATER IN DESALINATION PLANTS,
Hager und Elsaesser G.m.b.H., Stuttgart (Germany, F.R.).
K. Marquardt.
Desalination, Vol. 52, No. 1, p 43-55, December, 1984. 11 Fig, 3 Ref.

Descriptors: *Pretreatment of water, *Desalination, *Flocculation, *Precipitation, *Sedimentation, *Flotation, Water treatment, Water supply development, Brackish water, Seawater.

Groundwater, bank-filtered river water, brackish water and seawater are increasingly being contaminated by high salt contents and organic, colloidal matter. These different types of water can therefore not be fed to a desalination plant without prior pretreatment. Conventional pretreatment methods are characterized by extensive space requirement, excessive building costs and considerable amount of waste water and sludge which is produced. The objectives of this study were to use precipitation and flocculation reactions for removing inorganic and organic matter; to bring about separation of the suspension by using flotation and sedimentation; to apply these processes in compact units to minimize investment costs; and to include sludge treatment in water processing using mechanical techniques of dehydration. (Baker-IVI)
W86-01370

OPTIMIZING DESIGN AND COST OF SEAWATER REVERSE OSMOSIS SYSTEMS,
DHV Consulting Engineers, Amersfoort (Netherlands).
J. C. Van Dijk, P. J. De Moel, and H. A. Van Berkmortel.
Desalination, Vol. 52, No. 1, p 57-73, Dece 1984. 5 Fig, 7 Tab, 3 Ref.

Descriptors: *Desalination, *Resources de ment, *Saudi Arabia, *Reverse osmosis, water, Total dissolved solids, Dissolved Costs, Design criteria.

The influence of design parameters, such a water temperature and total dissolved solid tent (TDS), design pressure, and recovery, o unit cost for the production of desalinated from the Arabian Gulf in Saudi Arabia by of reverse osmosis is presented for plant cap ranging from 75,000 cu m/d to 700,000 cu Total unit water cost is significantly influenc raw water TDS, design pressure and design ery. Investigation of the feasibility of operat increased pressure is recommended. Total co reverse osmosis desalination are presented al function of salinity, with TDS levels ranging 3000 mg/l to 55,000 mg/l. (Author's abstract)
W86-01371

REHABILITATION OF AN UNECONO MSF PLANT IN THE CANARY ISL SPAIN,
PRODESA, Las Palmas de Gran Canaria (S
J. Guzman.
Desalination, Vol. 52, No. 1, p 75-85, Dece 1984. 5 Fig, 3 Tab.

Descriptors: *Desalination, Fuel, Econom pects, Evaporators, Spain, Fuerteventura I, recovery.

When the Fuerteventura I plant was instal 1970 in Spain, the price of fuel was about 15 lower than it is at present. It is currently pr tive to run the plant under the same cond Rehabilitation of the MSF desalination plan ducting 2000 cu m/day is described. Wast from diesel engine units in operation nearb been channeled at a reasonable, economically ble cost, to the local water authority. These gases have an average temperature of 400 d C. From the total heat energy of the fuel-o plied to a diesel engine only about 40% is co ed into mechanical energy; the remaining 6 wasted mainly in the form of heat as escape through the chimneys as well as the water c cylinders. The energy loss of the escape could even reach 40% of the fuel-oil tota energy. Three possible means of using these gases were explored: conducting the escape of the engines to a common collector and ins a single recovery boiler; removing the waste heat recovery boiler and providing diesel engine chimney with a new total wast recovery boiler for the full utilization of e gas energy; and eliminating only some of the ing partial waste heat recovery boilers and tuting new ones capable of total utilizati exhaust gas energy. The adopted solution co in replacing partial recovery boilers from chimney Nos. 1, 3 and 5 by total recovery b interconnecting chimneys of diesel 1-2 and order to take advantage of the residual e when twin engines are working at the same Thus it makes no difference which engine is ing at any one time, since the escape gases co conveyed indiscriminately to the new total ery boiler of either group. (Baker-IVI)
W86-01372

DESALINATION PLANTS WITH A CAPA OF MORE THAN 95 CU M/D INSTALLE JAPANESE MANUFACTURERS (AS OF J ARY 1, 1984),
Water Re-Use Promotion Center, Tokyo (J
J. Hori.
Desalination, Vol. 52, No. 1, p 87-93, Dece 1984. 4 Tab.

Descriptors: *Desalination, Evaporators, brane processes, Water management, Japan.

ary is given of desalination plants installed
ese manufacturers in Japan and overseas.
mary is presented in tabular form. Data is
into the following categories: desalination
ith a capacity of more than 95 cu m/d
by Japanese manufacturers as of January
desalination plants with a capacity of more
cu m/day installed in overseas countries;
feed/use breakdown of desalination plants
in Japan and overseas by Japanese manu-
in cu m/day. (Baker-IVI)
73

MICS OF MSF PLANTS: INFLUENCE
IATIONS IN THE DESIGN PARAM-
AND USE OF DIFFERENT CON-
ION MATERIALS,
nti S.p.A., Genoa.
ni, R. Borsani, G. Migliorini, and U.

ion, Vol. 52, No. 2, p 97-103, May, 1985.
Ref.

rs: *Desalination, *Economic aspects,
criteria, *Multistage flash distillation,
water, Capital costs, Construction costs,
rs, Water resources development.

which MSF (multistage flash distillation)
odified to meet the market demands of
and economics are considered. Three
e particularly taken into account: com-
tween technological features of the long
st cross flow MSF type, low cost mate-
on possibilities, and comparison of proc-
parameters of the long flow compared
ross flow MSF type. A substantial reduc-
ts (up to 5%) can be obtained adopting a
on material choice and process design
hich is fully reliable. This aim can be
rough two different steps. First, choice
parameters to reduce the dimensions of
evaporator. Second, choice of low cost
o reduce the unit cost of the MSF evap-
e annual capital cost is thus reduced
he initial capital cost and containing the
plant within usual terms. The cost of
uct water is substantially reduced and
parable with the cost of water for other
rocesses. (Baker-IVI)

BINE WASTE HEAT UTILIZATION
ILLATION,
Hochschule Aachen (Germany, F.R.).
erfahrenstechnik.
ach, and B. Arzt.
n, Vol. 52, No. 2, p 105-122, May, 1985.
ab, 5 Ref.

: *Desalination apparatus, *Waste heat,
nes, Distillation, Multiple effect stack
ulti-stage flash process, Cost analysis,
Water resources development.

many gas turbines in operation in the
and along the North African coast
uitable for use as a heat source for a
unit. The turbines operate in places
water is needed and they are located
a. The MES (multiple effect stack)
ound to be superior for this use com-
he standard MSF (multi-stage flash)
e cost of heating steam from a waste
is compared with the cost of steam
sources such as solar energy and fuel-
A MES unit will produce much more
comparable investment costs or, the
costs will be considerably lower in the
l distillate production. MES is espe-
d for low top-brine temperatures.

CAL VAPOUR COMPRESSION
APPLIED TO SEAWATER DESALI-
1,500 TON/DAY UNIT INSTALLED
CLEAR POWER PLANT OF FLA-
, FRANCE,
ernationale de Dessalement, Paris
(France).
M. Lucas, and B. Tabourier.
Desalination, Vol. 52, No. 2, p 123-133, May, 1985.
3 Fig, 3 Tab.

Descriptors: *Mechanical vapor compression process, *Desalination, *Seawater, Evaporation, Water quality, Costs, Drinking water, Industrial water, Water resources development.

The largest mechanical vapor compression process unit for seawater desalination in the world is a 1,500 cu m/d unit installed in the Nuclear Power Plant of Flammanville in France which supplies a high quality water to that plant. The process used in this skid-mounted package unit is distillation: spray-film evaporation working at low temperature (60 C) by mechanical vapor compression (13 C) and multistage process (4 effects). Advantages include: high energy savings; reliability; low temperature; compactness of package units which reduces the transportation and erection costs; simple seawater intake without particular pretreatment; seawater flow 2 times the production flow; high purity of distillate from any kind of seawater; easy operation and maintenance. Such units may be used to produce drinkable water or high purity process water for industrial needs. (Moore-IVI)
W86-01670

DEVELOPMENTS IN VERTICAL TUBE EVAPORATION,
Snamprogetti S.p.A., Milan (Italy). Desalination Dept.
M. Bertuzzi, M. Polla, and P. Tiraboschi.
Desalination, Vol. 52, No. 2, p 135-143, May, 1985.
4 Fig, 3 Tab, 3 Ref.

Descriptors: *Desalination, *Water treatment, *Vertical tube evaporation, Thermodynamics, Multistage flash plants, Snamprogetti process, Evaporation, Salinity, Water resources development.

Multiple effect desalination plants using falling film evaporation and vertical arrangement of the effects have proved significantly advantageous thermodynamically because of reduced energy consumption and advantageous due to high operational flexibilty and due to ease of erection in restricted areas. The combination of a vertical tube evaporation (VTE) plant with an existing multi-stage flash plant is presented with a view to improving its efficiency and production. The VTE plant based on Snamprogetti technology has proved highly reliable as demonstrated by the data relevant to the desalination plant at a refinery; the first unit has been running since March 1978 with a capacity of 1440 cu m/day with an 86% stream factor chiefly caused by shutdowns that occurred due to refinery requirements. The second unit, with a capacity of 2400 cu m/day has been running since October 1982 with a 99% stream factor. Additional utilization of VTE could make the multiple effect technology even more competitive. Desalination plants could be run at a high concentration factor (C.F. $>$ 2) and VTE could be combined with existing multi-stage flash (MSF) units. Operation at higher concentration factors is becoming important as the salinity of seawater has steadily increased along the Arabian Gulf due to the presence of numerous desalination plants. A case study demonstrated the advantages offered by a combined plant; in the case of separate plants the output is equal to that of a combined plant, but the performance ratio is far lower and corresponds to the mean of the MSF performance ratio (8.0 lb/kBtu) and the VTE performance ratio (5.1 lb/lBtu), that is 6.5 lb/kBtu, as compared to 12.3 lb/kBtu of the combined plant. The problem of revamping an existing MSF plant according to the flow diagram presented, can be easily solved from a practical viewpoint, because the installation of a VTE column requires a restricted area. (Collier-IVI)
W86-01671

SELECTION OF SMALL DESALINATION PLANTS FOR SPECIFIC LOCATIONS - REVERSE OSMOSIS, FLASH DISTILLATION, VAPOUR COMPRESSION,
Wangnick Consulting Engineers, Gnarrenburg (Germany, F.R.).
K. Wangnick.
Desalination, Vol. 52, No. 2, p 145-165, May, 1985.
29 Fig, 2 Tab.

Descriptors: *Desalination, *Reverse osmosis, *Flash distillation, *Vapor compression, Water treatment, Costs, Economic aspects, Thermodynamics, Decision making, Water resources development.

Selection criteria are given for small desalination plants (2000-3000 cu m/d) for specific locations using reverse osmosis (RO), multistage flash distillation (MSF) or mechanical vapor compression (VC) processes. Of prime economic importance to customers, consultants and manufacturers are peripheral location conditions and operating suitability. Choice by the manufacturers is especially complicated due to the fact that the decision for small plants is left to the bidder. However, based on knowledge of local conditions, manufacturers can anticipate costs. Examples given show that under the assumed conditions the MSF process cannot possibly be the most cost-effective. This applies also to RO when the required product is high-purity process water instead of drinking water. For drinking water any choice between MVC and RO is dependent on energy costs and the capitalization factor. (Author's abstract)
W86-01672

ECONOMICS OF SOLAR STILLS,
3 Plastira Street, Pefki 151-21, Athens (Greece) Tel. 01-8020236.
E. E. Delyannis, and A. Delyannis.
Desalination, Vol. 52, No. 2, p 167-176, May, 1985.
9 Fig, 2 Tab, 13 Ref.

Descriptors: *Desalination, *Economic aspects, *Solar stills, Solar radiation, Energy, Costs, Distillation, Solar distillation, Water treatment, Water resources development.

Since the intensity of solar radiation per unit of evaporating area is determined by nature, the output of a solar distillation unit in a given location can only be increased by increasing the evaporating surface. The productivity of a conventional solar still cannot be more than four to five l/sq m/d for high values of solar radiation. Solar distillation is a free energy operation, however low its efficiency because of low incident radiation. It requires a larger installation area for water production than other conventional desalination processes. Nevertheless it remains the best solution for remote areas and small communities where other water supply systems are not available. Eight solar still designs are illustrated and their physical limitations are discussed. Efficiency of the still plants may be increased by combination with solar collectors, use of available preheated water and by integration with rainwater catchment systems. Solar energy can be converted to thermal, mechanical or electrical energy and then utilized in the solar still process. Solar still efficiency may also be increased by preheating the feed water using condensers inside the solar stills; this method involves additional cost for installation and maintenance and thus may not be justified by the increase in efficiency obtained. It is more economic to install more still units than to attempt to increase the output of a single still by unconventional methods. Distillation with solar energy remains the most favorable process for small capacity water desalting for remote locations where there is considerable solar radiation, but where there are no erection and maintenance facilities or skilled personnel available. In contrast with other desalination processes, in which the cost of energy is very important, if not the major element, solar distillation involves virtually no energy cost. (Collier-IVI)
W86-01673

SEAWATER REVERSE OSMOSIS - AN ECONOMIC ALTERNATIVE TO DISTILLATION,
Du Pont de Nemours International S.A., Geneva (Switzerland).
D. C. Brandt.
Desalination, Vol. 52, No. 2, p 177-186, May, 1985.

Group 3A—Saline Water Conversion

5 Fig, 4 Tab, 3 Ref.

Descriptors: *Reverse osmosis, *Desalination, *Distillation, *Multistage flash distillation, Water treatment, Costs, Energy, Environmental effects, Water resources development.

During the last 10 years reversed osmosis (RO) has achieved growing acceptance as an economical and viable alternative to multi-stage flash distillation (MSF) for seawater desalting. The acceptance of this technology is further increasing as a result of plant performance histories and membrane improvements. The abundance of electricity in the Middle East combined with increasing demands for water and restraints on capital spending point to seawater RO as the technology whose time has come. Either alone or in combination with MSF, seawater RO can claim several benefits over MSF: Lower operating costs primarily as the result of energy cost savings. These savings are greater as energy cost increases. Flexibility of operation by the ability to use grid electricity, diversification of plant location and greater load following capability. Replacement of aging MSF plants at minimum capital cost. The ability for power plants to be efficiently designed and operated for power production rather than being controlled by water demands. Combined RO/MSF plants have synergistic benefits through efficiency of plant operation, load following capability, use of excess electricity, product water blending, and lower operating costs than MSF alone. Environmental effects are reduced for a specified quantity of power and water produced due to less fuel burned and warm water discharged to the sea. (Author's abstract)
W86-01674

SEAWATER DESALINATION BY REVERSE OSMOSIS PLANT DESIGN, PERFORMANCE DATA, OPERATION AND MAINTENANCE (TANAJIB, ARABIAN GULF COAST),
Preussag A.G. Bauwesen, Hemmingen (Germany, F.R.). Water Treatment Dept.
W. Heyden.
Desalination, Vol. 52, No. 2, p 187-199, May, 1985. 5 Fig, 5 Tab.

Descriptors: *Desalination, *Reverse osmosis, *Design criteria, *Tanajib, *Saudia Arabia, Water treatment, Seawater, Membrane processes, Water resources development.

A systematic interpretation of critical combinations of feed water, pretreatment and membranes can avoid setbacks in reverse osmosis (RO) processes. RO systems manufacturers will find the right approach if their responsibilities are expanded - beyond just design, construction, installation and commissioning - to an overall responsibility including operation and maintenance. In 1982/83 an oil company ordered a temporary RO seawater desalination plant for Tanajib, on the Arabian Gulf Coast of Saudi Arabia, with a total net capacity of 600,000 gpd. The orders were placed on a turnkey basis including operation and maintenance. The highlights of the RO seawater desalination plant are: shallow beach wells, ultrafiltration, vacuum deaeration, high-pressure multi-stage centrifugal pumps with an energy recovery turbine, single stage reverse osmosis and free programmable logic and process controller. During more than one and a half years of operation, product quantity and quality has always met the design specification. The excellent experience so far with the first temporary Tanajib reverse osmosis seawater desalination plant permit the conclusion that RO technology can avoid setbacks and may face distillation processes competition with confidence. (Author's abstract)
W86-01675

LOW-TEMPERATURE VAPOUR COMPRESSION AND MULTI-EFFECT DISTILLATION OF SEAWATER. EFFECTS OF DESIGN ON OPERATION AND ECONOMICS,
Israel Desalination Engineering Ltd., Tel-Aviv.
R. Matz, and Z. Zimerman.
Desalination, Vol. 52, No. 2, p 201-216, May, 1985. 11 Fig, 3 Tab.

Descriptors: *Distillation, *Vapor compression, *Seawater, *Design criteria, *Economic aspects, Water treatment, Water temperature, Low temperatures, Water resources development.

The design and operating factors are analyzed which lead to the great stability of operation and reliability of low-temperature horizontal tube vapor compression and multi-effect plants. These factors are stated, discussed, and an attempt is made to assess their relative contribution to process economics. Recent reports on the state of the art of desalination technology have indicated the leading position of both low-temperature vapor compression and horizontal tube multi-effect distillation, on technical and economic grounds, for both single- and dual-purpose plants. The practical experience of on-site performance of such has demonstrated the remarkable stability, flexibility and reliability of these processes in comparison with others. The basic concept of low-temperature operation (50-70 C) leads to a chain of interrelated consequences which have a profound effect on the design, economics, operation and maintenance of such plants, some of which can be evaluated in terms of plant and process economics. (Author's abstract)
W86-01676

3B. Water Yield Improvement

AGRICULTURAL BENEFITS FOR SENEGAL RIVER BASIN,
Army Engineer Battalion (79th), APO New York 09360. Company B.
G. L. Hargreaves, G. H. Hargreaves, and J. P. Riley.
Journal of Irrigation and Drainage Engineering, Vol. 111, No. 2, p 113-124, June, 1985. 4 Tab, 6 Ref, 1 Append.

Descriptors: *Senegal River Basin, *Mauritania, *Mali, *Water resources development, *Agriculture, Economic aspects, Costs, Crops, Computer programs, Irrigation, Water requirements.

A multipurpose water resource development project is proposed for construction and development in the Senegal River Basin. The plans include the irrigation of an area of 274,805 ha by the year 2030 in three countries: Senegal, Mauritania, and Mali. Agricultural benefits were estimated and analyzed by means of a computer program. The factors influencing crop yields were analyzed and summarized including crop selection, water, fertility, and management. Some of the considerations that will produce higher crop yields in future years are presented. It is proposed that the irrigation project management should be responsible for calculating crop water requirements and insuring acceptable irrigation efficiencies. A method is presented for estimating crop water requirements from maximum and minimum air temperatures. The desirability of using irrigation supplemental to rainfall for maximizing benefits from limited water is presented. The maximum contribution of a unit of irrigation water to yield is possible during the rainy season. Projected revenues and costs and years required for each crop to become economically profitable are presented in tables. (Author's abstract)
W86-01432

ECONOMICS OF MSF PLANTS: INFLUENCE OF VARIATIONS IN THE DESIGN PARAMETERS AND USE OF DIFFERENT CONSTRUCTION MATERIALS,
Italimpianti S.p.A., Genoa.
For primary bibliographic entry see Field 3A.
W86-01668

GAS TURBINE WASTE HEAT UTILIZATION FOR DISTILLATION,
Technische Hochschule Aachen (Germany, F.R.). Inst. fuer Verfahrenstechnik.
For primary bibliographic entry see Field 3A.
W86-01669

MECHANICAL VAPOUR COMPRE PROCESS APPLIED TO SEAWATER DE NATION: A 1,500 TON/DAY UNIT INSTA IN THE NUCLEAR POWER PLANT OF MANVILLE, FRANCE,
Societe Internationale de Dessalement, (France).
For primary bibliographic entry see Field 3A
W86-01670

DEVELOPMENTS IN VERTICAL TUBE ORATION,
Snamprogetti S.p.A., Milan (Italy). Desal Dept.
For primary bibliographic entry see Field 3A
W86-01671

SELECTION OF SMALL DESALINA PLANTS FOR SPECIFIC LOCATIONS VERSE OSMOSIS, FLASH DISTILLA VAPOUR COMPRESSION,
Wangnick Consulting Engineers, Gnarr (Germany, F.R.).
For primary bibliographic entry see Field 3A
W86-01672

ECONOMICS OF SOLAR STILLS,
3 Plastira Street, Pefki 151-21, Athens (G Tel. 01-8020236.
For primary bibliographic entry see Field 3A
W86-01673

SEAWATER REVERSE OSMOSIS - AN NOMIC ALTERNATIVE TO DISTILLATI
Du Pont de Nemours International S.A., (Switzerland).
For primary bibliographic entry see Field 3A
W86-01674

SEAWATER DESALINATION BY RE OSMOSIS PLANT DESIGN, PERFORM DATA, OPERATION AND MAINTEN (TANAJIB, ARABIAN GULF COAST),
Preussag A.G. Bauwesen, Hemmingen (Ge F.R.). Water Treatment Dept.
For primary bibliographic entry see Field 3A
W86-01675

LOW-TEMPERATURE VAPOUR COM SION AND MULTI-EFFECT DISTILL OF SEAWATER. EFFECTS OF DESIG OPERATION AND ECONOMICS,
Israel Desalination Engineering Ltd., Tel-A
For primary bibliographic entry see Field 3A
W86-01676

CURRENT STATUS OF DENVER'S PO WATER REUSE PROJECT,
Denver Water Dept., CO.
W. C. Lauer, S. E. Rogers, and J. M. Ray.
Journal of American Water Works Asso Vol. 77, No. 7, p 52-59, July, 1985. 6 Fig, 7 Ref. U.S. EPA contract CS-806821.

Descriptors: *Denver, *Colorado, *Water Water supply development, Water treatme nicipal water, Potable water, Drinking wate

The feasibility of directly treating pr wastewater plant effluent to potable qu being tested in Denver, Colo., with a full-s mgd (3.8-ML/d) demonstration plant. Th plexity of putting the system into operation results to date are described, along with an of the plans for health effects research, ec studies, and programs to gain public accept direct reuse. This project is expected to the information necessary to evaluate the fe of direct reuse, especially for cities loc water-scarce areas where development o conventional water resources is becoming ingly costly, both in terms of the environm in capital investments. (Author's abstract)
W86-01742

REUSE IN CALIFORNIA,
a Dept. of Health Services, Berkeley.

of American Water Works Association, No. 7, p 60-71, July, 1985. 4 Tab, 43 Ref.

ors: *Water reuse, *California, *Water t, *Irrigation practices, Groundwater re- Water quality, Public health, Water re- evelopment.

s in wastewater treatment technology and allow the safe reuse of effluent for sever- es when reasonable precautions are taken. urvey in California indicates that approxi- 20,000 acre-ft (272 million cu m) of er is reclaimed in the state by 240 er plants that supply reclaimed water to n 380 use areas. Irrigation accounts for ately 80% of the total quantity of er reclaimed in the state. Well over half used wastewater in the state is for the of fodder, fiber, and seed crops and for e irrigation of orchards and vineyards - do not require a high degree of er treatment. The Department of Health as established statewide wastewater rec- criteria for various uses, based on the human exposure to pathogens and other nts that could be present in treated r. For most uses of reclaimed water, agents pose a greater health risk than contaminants and quality standards are directed at these agents. The chemical ts are a major concern when reclaimed ed for indirect potable reuse via ground- arge and could also be a concern when water is used for crop irrigation. The contact between irrigation water and the ues of a crop - as influenced by the method practiced - will modify the type nt required for reclaimed water before ural use does not pose a health threat. regulations specify wastewater reuse for irrigation, impoundments and er recharge and include water quality treatment process requirements, sam- analysis requirements, operational re- , and treatment reliability requirements. I)

NG PUBLIC SUPPORT FOR REUSE

Univ., Berkeley. Dept. of Social Admin- ealth Services.
old.
American Water Works Association, p 1985. 4 Tab, 10 Ref.

: *Water reuse, *Public opinion, *Sur- udes, Public relations, Water resource nt, Potable water, Irrigation water, ater.

opinion surveys taken during the past ve shown remarkably similar attitudes e use of reclamined wastewater for d nonpotable purposes. The number of who were negative, opposed, or unfa- posed toward the concept ranged from for most studies; six of nine studies majority were opposed to the use of vastewater for drinking. Thirty to 50% ondents were positive or not opposed, favorable results associated with a posi- question phrasing. Although people are opposed to the use of reclaimed for drinking, there is a sizable minority t opposed, and thus there may be uses d wastewater for purposes other than at are much more acceptable to the lic. People having the most favorable vard using reclaimed wastewater for uld believe that their water supply was uted, that there was a water shortage , that technology for effectively treat- ter exists, that health risks involved in uses of reclaimed water are not sub- t economic benefits would accrue to ity that uses reclaimed water, and that on favors the use of reclaimed water.

Older, less well-educated people would have more negative attitudes, not because they are older and less well educated, but because they do not believe in water purification technology and because they do not believe a water supply shortage exists in their community; the opposite would be true of younger, better educated people. The survey research provides a basis for recommending the content of persuasive communications constituting an educational campaign. (Collier-IVI)
W86-01744

3D. Conservation In Domestic and Municipal Use

RECLAIMING DESERT LANDS THROUGH WATER REUSE,
Goff Consulting and Engineering Corp., Chandler, AZ.
For primary bibliographic entry see Field 5D.
W86-01746

CONSERVATION USING A RATE OF RETURN DECISION RULE: SOME EXAMPLES FROM CALIFORNIA MUNICIPAL WATER DEPARTMENTS,
California Univ., Santa Barbara. Dept. of Economics.
L. J. Mercer, and W. D. Morgan.
Water Resources Research, Vol. 21, No. 7, p 927-933, July, 1985. 5 Tab, 9 Ref. Bureau of Reclamation grant 14-34-0001-0477.

Descriptors: *Water conservation, *Rate of return, *Pricing, *California, Municipal water, Utilities, Simulation, Economic aspects.

A significant alternative to physical rationing of water to achieve conservation is provided by the price system. To act like profit maximizing firms, municipal water utilities (MWD's) should price their water so as to earn the opportunity cost of capital (the market rate of return) on the assets. The actual internal rate of return is calculated for a sample of 30 California MWD's for a 12-year period. For the 26 MWD's with a rate of return less than 10%, iterative simulations are run with increases in the MWD's average price to achieve the target rate of return. The magnitude of water conservation using the rate of return rule is reported for three alternative price elasticities of demand. The new implicit prices necessary to achieve the target rate of return are shown to be less than the cost of the cheapest new surface supply. (Author's abstract)
W86-01763

3F. Conservation In Agriculture

SALINE GROUNDWATER MANAGEMENT AND OPTIMAL CROPPING PATTERN,
Punjab Agricultural Univ., Ludhiana (India).
For primary bibliographic entry see Field 4B.
W86-01380

IRRIGATION SCHEDULING USING CROP INDICATORS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 7B.
W86-01433

FURROW IRRIGATION SIMULATION TIME REDUCTION,
California Univ., Davis. Dept. of Agricultural Engineering.
M. Rayej, and W. W. Wallender.
Journal of Irrigation and Drainage Engineering, Vol. 111, No. 2, p 134-146, June, 1985. 6 Fig, 15 Ref.

Descriptors: *Furrow irrigation, *Irrigation practices, *Computer models, Model studies, Moving boundary method, Infiltration.

Temporal and spatial changes in the flow profile decrease with time under furrow irrigation, and these slow changes suggest modifications in the simulation methods. Geometrically increasing time steps and node deletion at the upstream boundary are introduced and evaluated for accuracy and CPU time reduction. Increasing the time steps reduced CPU time without sacrificing accuracy significantly in predicting advance. The geometric progression factor is estimated automatically from the first two advance increments, thus incorporating site-specific flow and infiltration characteristics. The moving left boundary method is slightly more accurate, but is less cost-efficient than the varying time-step modification for the example conditions. However, special infiltration conditions may favor the latter method. (Author's abstract)
W86-01434

EFFICIENT WATER USE IN RUN-OF-THE-RIVER IRRIGATION,
Central Luzon State Univ., Munoz (Philippines). Dept. of Agricultural Engineering.
H. L. Angeles, and R. W. Hill.
Journal of Irrigation and Drainage Engineering, Vol. 111, No. 2, p 147-159, June, 1985. 3 Fig, 5 Tab, 10 Ref, 1 Append.

Descriptors: *Irrigation practices, *Water use efficiency, *Philippines, Hydrographs, Model studies, Soybeans, Rice, Drainage, Costs, Seasonal variation.

Irrigation water demand, crop yield and water allocation models were developed and applied to a Philippine run-of-the-river irrigation project. Dry season water supply hydrographs were classified into four levels of availability from high (I) to low (IV). These levels were correlated with the October stream flow volume to provide a prediction of dry season supply. Project net annual benefits could be increased for all four season water supply hydrograph levels by growing an upland crop (soybean) and rice, instead of only rice, providing that costs were less than $90/ha for additional drainage facilities. Net benefits for all rice were greater for reduced area planted, but fully irrigated when the available dry season water supply was lower than average as compared to planting the total area with inadequate irrigation. The irrigation system water demand model was calibrated to match actual diversions for the 1977-78 dry season. The project irrigation efficiency, combined effects of conveyance and application, was determined to be 41%. Thus, a savings in available water supply could be realized by increased system efficiency both from physical modifications as well as from improved management. (Author's abstract)
W86-01435

REUSE SYSTEM DESIGN FOR BORDER IRRIGATION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
M. Yitayew, and D. D. Fangmeier.
Journal of Irrigation and Drainage Engineering, Vol. 111, No. 2, p 160-174, June, 1985. 4 Fig, 5 Tab, 17 Ref, 1 Append.

Descriptors: *Water reuse, *Border irrigation, *Irrigation practices, Design criteria, Model studies, Runoff.

Significant and rapid improvement in surface irrigation systems is needed to minimize critical water shortages. There is a great potential for improving surface irrigation systems without affecting the farmer's application method; this can be done with reuse systems. The primary purpose of a reuse system is to collect irrigation runoff water and control it for furthur use. The system requires a sump or reservoir to collect and store the water, pump facilities for pumping it back, and a pipeline or canal for conveying water back to the irrigation system. A procedure is presented for designing a system to reuse runoff from free outflow irrigation borders. Runoff volumes are obtained using four dimensionless variables and runoff curves developed with a zero-inertia mathematical model. The equations make use of runoff curves previously developed to give the components of the reuse system, mainly the sump and pump sizes. Use of

the ultimate post irrigation subsurface water profile was made to get the time of runoff without the need for different design curves. An example of the design procedure includes different modes of reuse system operation. (Collier-IVI)
W86-01436

VOLUMETRIC PRICING OF AGRICULTURAL WATER SUPPLIES: A CASE STUDY,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6C.
W86-01766

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SOUTHLAND FLOOD OF JANUARY 1984,
Southland Catchment Board, Invercargill (New Zealand).
For primary bibliographic entry see Field 2E.
W86-01388

IMPACT OF RIVER CHANNELIZATION; II. CHANNELIZATION: SOME ENGINEERING ASPECTS,
North West Water Authority, Warrington (England). Rivers Div.
D. L. Hockin.
Geographical Journal, Vol. 151, No. 1, p 54-57, March, 1985.

Descriptors: *Channeling, *Land development, *Flood control, Environmental effects, Design criteria, Drainage, Hydraulic design.

One reason for channelization is to control urban flooding. Land developers have noticed that the floodplain area along a river frequently offers flat land for easy industrial, residential and recreational development, ignoring the fact that this same land is subject to floods during major storms. Other problems which require attention to proper channelization arise from the need to provide improved drainage of agricultural land, and taking care that mining subsidence does not adversely affect natural drainage. Factors which influence channel design and are considered here include hydraulic parameters, the standard of protection that is adopted, adjoining land use, ground conditions, maintenance requirements for channel works, and environmental and amenity aspects. Two of the most frequent criticisms of the engineer's channelization work are indiscriminate removal of trees and vegetative cover from the banks of watercourses and excessive straightening. (Baker-IVI)
W86-01402

IMPACT OF RIVER CHANNELIZATION; III. DOWNSTREAM MORPHOLOGICAL CONSEQUENCES OF RIVER CHANNELIZATION IN ENGLAND AND WALES,
Miljoestyrelsen, Silkeborg (Denmark). Freshwater Lab.
A. Brookes.
Geographical Journal, Vol. 151, No. 1, p 57-62, March, 1985. 3 Fig, 11 Ref.

Descriptors: *Channeling, *England, *Wales, *Environmental effects, *Channelization, Water resources development, Land use, Erosion control, Rivers, Construction, Stream morphology.

Recent field investigations of the downstream morphological consequences of river channelization at a total of 57 water authority sites were reviewed. This research indicates that the downstream consequences can be divided into those effects associated with construction, and characterized by the release of excess amounts of sediment, and those which occur during the years following completion of a scheme in response to changes in the frequency and magnitude of discharges. The majority of sites studied in high energy environments in England and Wales underwent some form of erosive adjustment in the downstream reach in the long term and it is proposed that the increased flows generated by each scheme were sufficient to exceed a threshold required for erosion. Channel enlargement varied spatially, declining with distance away from each channelization scheme. A further type of channel change observed was the accentuated erosion of the outside of bends, but without the associated point bar deposition characteristic of natural landform changes. The majority of sites studied in low energy environments in lowland Britain had not undergone downstream channel change. Analyses of the amount of change produces relationships which can be useful in indicating the amount of adjustment likely in specific situations. (Baker-IVI)
W86-01403

IMPACT OF RIVER CHANNELIZATION; IV. THE ECOLOGICAL EFFECTS OF CHANNELIZATION,
Welsh Water Authority, Nelson. South East District.
For primary bibliographic entry see Field 6G.
W86-01404

RIVER RECESSION ANALYSIS IN THE OPERATIONAL MANAGEMENT OF LAKE ABSTRACTION,
For primary bibliographic entry see Field 2E.
W86-01522

4B. Groundwater Management

GROUNDWATER IN WATER RESOURCES PLANNING: CONJUNCTIVE USE,
Universidad Politecnica de Valencia (Spain).
A. Sahuquillo.
Water International, Vol. 10, No. 2, p 57-63, June, 1985. 25 Ref.

Descriptors: *Groundwater, *Water supply development, *Conjunctive use, Planning, Water management, Water storage, Drought, Water supply.

Growing water needs, the constraints caused by water pollution and the cost of water development projects, including the cost of responding to social and environmental concerns, are increasing dramatically. It has become imperative to take into consideration all water sources and facilities in order to satisfy present and future water demands. Although groundwater has very often been overlooked by planning specialists, it can offer technical and economic advantages worthy of consideration. Groundwater can provide additional resources as well as the means for water storage, distribution and treatment, which can be combined advantageously with surface water resources. Likewise, groundwater can provide other advantages such as its adaptability to a progressive increase in the demand for water, the possibility of temporary overexploitation as a means to defer costly construction projects, mitigate the effects of droughts and alleviate drainage problems. (Baker-IVI)
W86-01375

SALINE GROUNDWATER MANAGEMENT AND OPTIMAL CROPPING PATTERN,
Punjab Agricultural Univ., Ludhiana (India).
M. P. Kaushal, S. D. Khepar, and S. N. Panda.
Water International, Vol. 10, No. 2, p 86-91, June, 1985. 1 Fig, 5 Tab, 15 Ref.

Descriptors: *Irrigation water, *Groundwater management, *Saline waters, *Cropping patterns, Conjunctive use, Water resources, Water quality, Water supply development, Model studies.

A decision model has been developed for optimal cropping pattern based on both leaching requirements and salinity response functions. This model, a deterministic linear programming model, represents the real world situation prevailing in different regions of the world. The model has been a to the command area of a minor canal to t real world problem. The design discharge minor canal is 59 liters/s. The culturable cor area is 28 ha. The full supply days in winter and monsoon season are 131 and 146, respec The command area is irrigated by can groundwater. In order to find the optimal cr pattern and optimal canal and saline groun mix, the possibility of increasing available w mixing canal and saline groundwater in a proportion was examined. The model effe adjusted the cropping pattern according availability of irrigation water as one would in the real world situation. Top priority sho accorded to irrigation extension activities courage conjunctive surface water-groun use. The optimal mixing of surface water an quality groundwater is essential for maximiz returns and to ensure optimum soil conditi plant growth. (Baker-IVI)
W86-01380

DIFFERENCES IN ANNUAL EVAPORA BETWEEN GRAZED PASTURE AND E LYPTUS SPECIES IN PLANTATIONS SALINE FARM CATCHMENT,
Commonwealth Scientific and Industrial Re Organization, Wembley (Australia). Di Groundwater Research.
For primary bibliographic entry see Fiel
W86-01473

GROUNDWATER AT HOME AND ABI
Birmingham Univ. (England). Dept. of Civil neering.
For primary bibliographic entry see Field 2F
W86-01524

EFFECT OF INCOMPLETE RECO PRIOR TO A PUMP TEST IN A LARGE-I ETER WELL,
National Geophysical Research Inst., Hyd (India).
For primary bibliographic entry see Field 2F
W86-01664

CAN WE SAVE THE OGALLALA,
Texas Tech Univ., Lubbock. Dept. of Civil neering.
R. M. Sweazy.
Civil Engineering, Vol. 55, No. 8, p 36-39, A 1985. 3 Fig.

Descriptors: *Ogallala Aquifer, *High *Texas, *Groundwater management, Artifi charge, Water conservation, Water reuse, I nation, Weather modification, Aquifers.

Management of the Ogallala aquifer has widely criticized, but half truths and misinter tions abound. Water conservation on the Plains takes many forms. Crops have been g cally manipulated to increase their tolera drought. Irrigation practices have been mo on farms, city parks and lawns, moisture det devices determine when to irrigate and how water to apply. Reclaimed municipal waste has been used for almost 50 years for irrigati industrial cooling. Surface drainage on the Plains of Texas tends to be to playa lakes, sh basins several hundred feet across that occu rally about one per square mile. A combinat current and future conservation practices, re water, recharge and secondary recovery well render the Ogallala a quasi-stable aqu the next century. All this depends on mo search. Areas to be investigated are the c desalination, which could provide a va source of water supply, and weather modifi (Baker-IVI)
W86-01737

COMPONENTS OF FLOW RESULTING F ABSTRACTION IN A TWO-LAYERED FINED AQUIFER WITH NO CROSS F
Institute of Hydrology, Wallingford (England

nary bibliographic entry see Field 2F.
770

ffects On Water Of n's Non-Water ivities

TERM STREAMFLOW OBSERVA-IN RELATION TO BASIN DEVELOP-

Aeronautics and Space Administration, lt, MD. Hydrological Sciences Branch.

of Hydrology, Vol. 78, No. 3/4, p 243-260, 35. 11 Fig, 1 Tab, 29 Ref.

ors: *Streamflow, *Land use, *Water-Forests, Urban areas, Cultivated lands, ds, Suburban areas, Overland flow, Eva-ration, Chester Creek basin, Pennsylva-

ds located in rapidly developing areas complex land-use transitions in relation to unidirectional trends generally displayed rural areas. The Chester Creek basin, southeastern Pennsylvania is representa-veloping areas in the Northeast. Stream-mated by the Thornthwaite Water Bal-hod was used as an unbiased control to ate an increase in actual runoff during the riod of record. Relationships between w and the historical trends of five land sses, forest, urban, residential, cultivated and open grass were investigated. While d residential areas experienced an in-rop lands steadily decreased. Forested ially decreased, then increased, while s first increased then decreased rapidly. ffect on the basin has been an increase in flow and a decrease in evapotranspira-ial, growing and dormant season stream-found to have increased 51, 57 and 46% ly. Evidence suggests that these in-e the direct result of changes in the aracter of the basin. (Author's abstract) 2

QUALITY EFFECTS OF PINE ODS SILVICULTURE,
niv., Gainesville. School of Forest Re-d Conservation.

Soil and Water Conservation, Vol. 40, 06-309, May-June, 1985. 1 Fig, 1 Tab, 14

s: *Water quality, *Pine trees, *Forest nt, Florida, Cutting management, Forest , Hydrogen ion concentration, Suspend-ts, Calcium, Potassium, Nonpoint pollu-s.

tersheds in the poorly drained pine region of north central Florida were for 6 years. Three silvicultural treat-e imposed during the second year; har-minimum disturbance and site prepara-st with maximum disturbance and site , and an undisturbed control. The mini-nent included manual shortwood har-ash chopping, soil bedding, and ma-ting. The maximum treatment included e-length harvesting, slash burning, win-soil bedding, and machine planting. e small but significant increases in pH, sediment, Ca, and K, proportional to of disturbance during the treatment K and Ca levels remained significant first post-treatment year. Minimum-dis-actices with protective stream manage-will minimize nonpoint-source pollu-or's abstract)

ED PROTECTION STRATEGIES SCITUATE RESERVOIR,
nd Dept. of Environmental Manage-idence. Office of Environmental Co-ordination.
L. B. Joubert.
Journal of the New England Water Works Association, Vol. 99, No. 2, p 136-156, June, 1985. 8 Ref.

Descriptors: *Scituate Reservoir, *Rhode Island, *Watershed protection, *Water quality control, Water quality, Drinking water, Water resources development, Non-point pollution sources, Land use, Hazarous materials spills.

The Scituate Reservoir is the sole source of water for the City of Providence and the surrounding metropolitan area. The watershed is predominantly rural in character but it is certainly not isolated. The current study confirmed the excellence of the water quality in the Reservoir. Watershed management and emergency spill response has been effective in maintaining water quality. Contaminants that do find their way into the reservoir from non-point sources and spills have been assimilated and diluted within the system with little effect. Future water quality is subject to increasing traffic volumes and growth pressures - factors over which there is presently little control. Objectives of proposed actions are to improve highway safety and drainge, reduce the amount of hazardous materials transported across the watershed, promote more efficient spill response, and control non-point source discharges through land use management. (Baker-IVI)
W86-01752

GLOBAL STATUS AND TREND OF DESERTIFICATION,
United Nations Environment Programme, Nairobi (Kenya). Desertification Branch.
For primary bibliographic entry see Field 2B.
W86-01855

WATER QUALITY OF A SMALL URBAN CATCHMENT NEAR DURBAN, SOUTH AFRICA,
Durban-Westville Univ. (South Africa). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W86-01861

4D. Watershed Protection

LIMITS ON THE USEFULNESS OF EROSION-HAZARD RATINGS: EXPERIENCES IN NORTHWESTERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
R. M. Rice, and P. D. Gradek.
Canadian Journal of Forest Research, Vol. 14, No. 4, p 559-564, August, 1984. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Erosion-hazard ratings, *Logging, *California, Forest management, Soil erosion, Erosion control, Yarding, Prediction.

Although erosion-hazard ratings are often used to guide forest practices, those used in California from 1974-1982 have been inadequate for estimating erosion potential. To improve the erosion-hazard rating procedure, separate estimating equations were used for different situations. The ratings were partitioned according to yarding method, erosional process, and both yarding method and erosional process. Partitioning by yarding method resulted in a slight improvement in the precision of erosion estimates. The other two methods resulted in fourfold increases in prediction errors. Results indicate that a single unified erosion-hazard rating procedure is the most practical way of predicting logging-related erosion in northwestern California. (Author's abstract)
W86-01783

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SPECIES DIVERSITY OF ALGAL FLORA IN VISHWAMITRI RIVER, BARODA (INDIA),
S.S.V.P. Santha's Science Coll., Dhule (India). P.G. Dept. of Botany.
S. N. Nandan, and R. J. Patel.
Polskie Archiwum Hydrobiologii, Vol. 32, No. 1, p 1-6, 1985. 4 Tab, 12 Ref.

Descriptors: *Species diversity, *Algae, *Vishwamitri River, *Baroda, *India, Physico-chemical characteristics, Water pollution, Bioindicators, Indicators, Chemical oxygen demand, Carbonates, Alkalinity, Nitrates, Phosphates, Calcium, Total solids, Water pollution effects.

Shannon's diversity index was studied to analyze the structure of the algal community in the Vishwamitri river flowing through Borada city during December, 1980 to December, 1982. The diversity index was calculated according to Shannon's function. All the three stations selected did not show any difference in the mean values of DI, but the values of each month showed slight variation. The diversity index was correlated with 17 physico-chemical parameters. It showed direct relationships with carbonate, total alkalinity, nitrate, phosphate, calcium and total solids whereas it showed inverse relationships with COD at all 3 stations. DI holds promise as an index for determining the degree of pollution. (Author's abstract)
W86-01325

INDICATORY ROLE OF SOME INVERTEBRATES FOR QUALITY OF WATER IN THE VISTULA RIVER AND IN SUBSEQUENT STAGES OF ITS TREATMENT,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
H. Sztrantowicz, and M. Kaniewska-Prus.
Polskie Archiwum Hydrobiologii, Vol. 32, No. 1, p 71-95, 1985. 13 Fig, 34 Ref.

Descriptors: *Vistula River, *Warsaw, *Poland, *Invertebrates, *Bioindicators, Paramecium, Daphnia, Crustaceans, Water pollution, Indicators, Water quality, Water treatment.

Based on previously published data on physical and chemical properties of Vistula River water treated for municipal use in the city of Warsaw the processes of mortality, adaptation and reproduction were traced in Paramecium aurelia, P. caudatum and Daphnia magna. In the case of Protozoa, growth parameters of the population were examined (growth rate, generation time) under effect of changes in water chemical properties. It was shown that there is a dependence between water quality as calculated by the method of averaged discriminants, and mortality of test animals. Seasonal and annual changes in mortality of Daphnia magna in the water examined were also ascertained. The organisms used for studies are good bioindicators for the aquatic environment with a high degree of chemical pollution. (Author's abstract)
W86-01327

ESTIMATING THE EXTENT OF REDUCTION NEEDED TO STATISTICALLY DEMONSTRATE REDUCED NON-POINT PHOSPHORUS LOADING TO LAKE ERIE,
Heidelberg Coll., Tiffin, OH. Water Quality Lab.
For primary bibliographic entry see Field 5G.
W86-01343

METAL CONCENTRATIONS IN THE GROUND WATER OF THE OUCHITA MOUNTAINS, ARKANSAS, U.S.A.,
Arkansas Univ., Fayetteville. Dept. of Geology.
G. H. Wagner, and K. F. Steele.

Water, Air, and Soil Pollution, Vol. 25, No. 3, p 339-347, July, 1985. 2 Fig, 2 Tab, 18 Ref.

Descriptors: *Groundwater, *Metals, *Ouachita Mountains, *Arkansas, Manganese, Drinking water, Water quality, Lead, Iron, Zinc, Cadmium, Copper, Cobalt, Nickel, Mercury, Antimony, Strontium, Barium.

Groundwater in the Ouachita Mountains near deposits of Mn-oxide mineral deposits have anomalously high Mn and Fe concentrations in a significant percentage of cases (Mn-50%, Fe-44%) and background concentrations of Mn and Fe for these groundwaters tend to be greater than for lesser mineralized areas. There is some evidence that the trace metals in these Mn mineral deposits also are reflected in greater groundwater concentrations. Barite and cinnabar mineral deposits are similarly reflected in higher concentrations of Ba and Hg, respectively, not only in the groundwater near these deposits, but also generally in the mineralized districts. The concentrations of Mn and Fe in about 30% of the springs exceeded the EPA drinking water criteria of 50 micro-g/L Mn and 300 micro-g/L Fe. Three springs exceeded the EPA criterion for Pb of 50 micro-g/L, one spring exceeded the 2 micro-g/L Hg criterion and no Ba concentrations exceeded the Ba criterion of 1000 micro-g/L. (Baker-IVI)
W86-01357

DETERMINATION OF ALKYLPHENOLS AND ALKYLPHENOL MONO- AND DIETHOXYLATES IN ENVIRONMENTAL SAMPLES BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
M. Ahel, and W. Giger.
Analytical Chemistry, Vol. 57, No. 8, p 1577-1583, July, 1985. 4 Fig, 4 Tab, 19 Ref.

Descriptors: *Pollutant identification, *Alkylphenols, Chromatography, Organic compounds, Wastewater analysis, Water analysis, High-performance liquid chromatography, Mass spectrometry, Gas chromatography.

Rapid, reliable and sensitive methods for the quantitative determination of alkylphenols (AP), 4-alkylphenol mono- (AP1EO) and diethoxylates (AP2EO) in wastewaters, natural waters, and sludges were sought. The necessary prerequisites for successful quantitative determinations of chemicals in environmental research are efficient and preferably selective enrichment, effective separation, and specific and sensitive detection. For routine determinations of large numbers of samples, simplicity and ease of operation as well as short analysis times are desirable. The normal-phase high-performance liquid chromatography (HPLC) method for the quantitative determination of 4-nonylphenol, 4-nonylphenol mono- and diethoxylate described largely fulfills these requirements. High-resolution gas chromatography/mass spectrometry and reversed-phase HPLC may serve as confirmatory techniques to ensure correct identifications. A broad range of aqueous and solid samples from different processes of wastewater and sludge treatment and from various compartments of the environment can be analyzed. The method is particularly suitable for investigations of the occurrence and fate of AP, AP1EO and AP1EO in sewage sludges, treated wastewaters and in the aquatic environment. (Baker-IVI)
W86-01389

MICROBIAL ASSAY FOR DETERMINING THE INFLUENCE OF PHYSICOCHEMICAL ENVIRONMENTAL FACTORS ON THE TOXICITY OF ORGANICS: PHENOL,
New York Univ., NY. Lab. of Microbial Ecology.
For primary bibliographic entry see Field 5C.
W86-01407

IMPACT OF LAND-APPLIED INCINERATOR ASH RESIDUE ON A FRESHWATER WETLAND PLANT COMMUNITY,
Massachusetts Univ., Waltham. Suburban Experiment Station.
For primary bibliographic entry see Field 5C.
W86-01466

GRADIENTS OF PIGMENT CONCENTRATION IN MARINE CONTAMINATED SYSTEMS (GRADIENTES PIGMENTARIOS EN SISTEMAS MARINOS SOMETIDOS A EFLUENTES CONTAMINANTES),
Malaga Univ. (Spain). Dept. de Ecologia.
P. Algarra, and F. X. Niell.
Investigacion Pesquera, Vol. 49, No. 1, p 107-119, 1985. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Chlorophyll a, *Marine environment, Water pollution effects, Probability, Pigments.

The Whitney and Darley's method to estimate chlorophyll a free of degradation products, has been compared with the classical method of Talling and Driver which does not discriminate these interferences. Both methods have been used to estimate gradiental changes in three sytems stressed by a single or a double focus. The amount of impact, as a percent, has been estimated by means of a probabilistic method based on Montecarlo methodology using as variable the values of active chlorophyll a. The general discussion of the data suggest problems of theoretical interest. (Author's abstract)
W86-01495

SIMPLE, COMMUNITY LEVEL, ECOTOXICOLOGICAL TEST SYSTEM USING SAMPLES OF PERIPHYTON,
Goeteborg Univ. (Sweden). Dept. of Botany.
H. Blanck.
Hydrobiologia, Vol. 124, No. 3, p 251-261, May, 1985. 8 Fig, 4 Tab, 59 Ref.

Descriptors: *Periphyton, *Photosynthesis, *Phytotoxicity, Water pollution effects, Algae, Ecotoxicity, Aliphatic amines, Industrial wastewater, Textile industry.

The design and performance of a simple, community level ecotoxicological test system is reported. Samples of periphyton communities, established on artificial substratum in natural streams were used to study effects on photosynthetic activity in short-term experiments. Photosynthesis was measured as light-dependent oxygen evolution or as C-14 labeled CO2-incorporation. The variability in photosynthetic activity between samples collected at the same time, expressed as coefficient of variation, was ca. 20%. The variation in sensitivity of periphyton photosynthesis as dependent on sampling season was less than threefold for the two long-chained aliphatic amines and the textile industry effluent studied. Effects of the amines on periphyton from five different streams were also investigated. The ratio between maximum and minimum values of sensitivity was 5.6. It is concluded that the variation in sensitivity between different periphyton communities is similar to or less than that observed for fresh-water algal species. Some advantages with regard to ecological realism of using periphyton communities as test systems are discussed. (Author's abstract)
W86-01507

QUANTITATIVE CHEMOBEHAVIOR OF FISH: AN IMPROVED METHODOLOGY,
Texas A and M Univ., College Station. Dept. of Veterinary Anatomy.
A. D. Scarfe, C. W. Steel, and G. K. Rieke.
Environmental Biology of Fishes, Vol. 13, No. 3, p 183-194, July, 1985. 7 Fig, 27 Ref.

Descriptors: *Fish behavior, *Monitoring, *Octagonal fluvarium, Behavior, Water pollution, Odor, Chemobehavior, Food habits.

A new behavioral monitoring system, an 'octagonal fluviarium', and associated time-series analytical techniques were developed to quantitatively examine and assess the chemobehavior of fish to waterborne chemicals. Together they aid in the solution of many of the quantitative behav physical problems inherent in earlier exp approaches. The fluviarium utilizes a quas channel in which fish are able to mo through any of eight areas, any of w/ receive a predetermined concentration of cal stimulus. Movements and preferential animals monitored with a video system lyzed to determine spatial and temporal p in their distributions within the system in to introduced chemicals. The advantages designs include precise control of the w dynamics affecting the odor plume, virtua tion of the 'wall-hugging' tendency of an to the quasi-circular construction of the trough, and the assessment of temporal c the behavioral responses of the animals w be correlated with the presence of od cues. The efficacy of the fluviarium and analysis is illustrated with data on the sponse of zebrafish, Brachydanio rerio, to L-alanine. This system should have extens cation in investing the chemoresponses o organisms to waterborne chemicals (pres gularly and in combinations) such as f stances, pheromones or pollutants. (Aut stract)
W86-01509

MONITORING AND EVALUATIO WATER POLLUTION IN TUMEN RI MEANS OF ALGAE (IN CHINESE),
Academia Sinica, Lochiaschan (China). Hydrobiology.
For primary bibliographic entry see Field
W86-01512

ORGANOCHLORINES AND TRACE IN GREEN-LIPPED MUSSELS PERN DIS FROM HONG KONG WATERS: OF INDICATOR ABILITY,
Environmental Protection Agency, (Hong Kong).
D. J. H. Phillips.
Marine Ecology - Progress Series, Vol. p 251-258, February, 1985. 1 Fig, 3 Tab

Descriptors: *Bioindicators, *Chlorinate carbons, *Trace metals, *Mussels, *Ho Copper, Lead, Cadmium, Mercury, Zin Polychlorinated biphenyls, Pesticides, waters.

While the use of biological indicators to aquatic pollution by trace elements and lorines is well-established in temperate w technique has been relatively little used areas. This is partly because a suitable s yet to be identified. In South-East Asia, lipped mussel Perna viridis (Linnaeus) proposed as a candidate for regional bi studies. The capacity of P. viridis to efficient and accurate bio-indicator for tr and organochlorines has been tested in H coastal water, using samples from 15 loca concluded that P. viridis is an excellent tor species for studies of copper and lead. monitor cadmium, mercury and zinc re ther study, however; in particular, the m partially metabolically regulate zinc conc in its tissues. P. viridis appears to be indicator species for organochlorines; th ported here reveal a generalized contam Victoria Harbor by DDT and its metab localized pollution by PCBs. (Author's
W86-01514

POLYCHLORINATED BIPHENYLS HUDSON RIVER: THE VALUE OF UAL PACKED-COLUMN PEAK ANAL
Lamont-Doherty Geological Observat sades, NY.
H. J. Simpson, R. F. Bopp, B. L. Deck, S and N. Kostyk.
Northeastern Environmental Science, V 3/4, p 159-165. 10 Fig, 6 Tab, 14 Ref.

Descriptors: *Polychlorinated biphenyls, River, *New York, *Packed-column pea

ical analysis, *Fate of pollutants, Chlorinat-drocarbons, Sediments, Chemical composi-

result of discharges of approximately 500 PCBs since the 1940's, the sediments, water ta of the Hudson River (New York) over a reach are contaminated to a level up to orders of magnitude greater than other rban river-estuaries in North America. Al- the original contamination probably con- predominantly of unmodified commercial ixtures, especially Aroclor 1242 which was about 80 km upstream of tidal waters, the ive effect of physical and biological proc- ncluding sorption and desorption to and spended particles and sediments plus gas e between the water and atmosphere, has accomplish major changes in PCB compo- nposition in sediments along the axis of the dson. Much of the scientific value of envi- al PCB measurements in the Hudson is lost rting of data as total PCB concentrations, an in terms of a number of distinct compo- leally, each of the more than 100 individual ngeners that can be analyzed in environ- amples by capillary column chromatogra- uld be separately reported, but in practice cant advance would be accomplished by g data in terms of mass of PCB represen- individual peaks resolved by packed- chromatography (each peak includes sev- nct compounds with very similar physio- properties). Less informative, but never of considerable value, is the practice of data in terms of one or more commercial mixtures, especially if the method of zation is carefully documented (i.e. which gram peaks are actually used for both the and sample). Comparison of PCB compo- ased on individual packed-column peak n depth segments of a sediment core from upstream end of the tidal Hudson demon- at even relatively subtle changes in PCB mposition (conversion from Aroclor 1242 r 1016), such as occurred at the upstream cilities in 1971-1972, can be clearly ob- the sediments many 10's of km down- f the release points, providing a useful hic marker. In contrast to such subtle n PCB source composition to the tidal er Hudson, major differences are ob- sediment PCB composition near New . In an area such as Jamaica Bay, which isolated from the influence of down- nsport of PCBs from the capacitor plant ediment PCBs contain much greater pro- f higher chlorinated biphenyls (penta- biphenyls) than the main stem of the probably due to the impact of domestic scharges. Such large difference in com- rovide the single most useful set of infor- r characterizing sources and transport of this family ot toxic contaminants in n. (Author's abstract)
6

YING POLLUTION RELATED S IN CHIRONOMID COMMUNITIES ICTION OF TAXONOMIC RANK,
National Lab., TN. Environmental Sci-

y bibliographic entry see Field 5C.

INATION OF THE STOCK OF FISH NGUILLA ROSTRATA) BASED ON SENCE OF THE SYNTHETIC CHEM- IREX (DISCRIMINATION D'UN E POISSON, L'ANGUILLE (ANGUIL- RATA), BASEE SUR LA PRESENCE ODUIT CHIMIQUE DE SYNTHESE,
t of Fisheries and Oceans, Quebec. esearch Branch.
y bibliographic entry see Field 5C.

ORGANISMS AS INDICATORS OF QUALITY IN LAKE PATZCUARO,
Universidad Nacional Autonoma de Mexico, Mexico City. Dept. de Quimica de la Atmosfera y Estudios del Agua.
I. Rosas, M. Mazari, J. Saavedra, and A. P. Baez.
Water, Air, and Soil Pollution, Vol. 25, No. 4, p 401-414, August, 1985. 8 Fig, 3 Tab, 34 Ref.

Descriptors: *Lake Patzcuaro, *Mexico, *Benthos, *Water quality, *Bioindicators, Water pollution effects, Bacterial analysis, Animal wastes, Invertebrates, Aquatic plants, Wastewater pollution.

The water quality was evaluated in Lake Patzcuaro by biological methods using bacteria and macroinvertebrates as indicators, as well as physicochemical parameters. The bacteriological determinations showed critical areas near the two main villages, Patzcuaro and Janitzio. The bacterial ratio FC/FS indicated significant amounts of animal excreta throughout the lake. In areas with less urban influence where there was an abundance of immersed vegetation, the benthic macroinvertebrate community presented high Bioic, Diversity, and Equitability Indices, which were > 2, > 2, and > 0.6, respectively. At the most polluted station (station 8), oligochaetes, which are tolerant to organic matter, comprised 94% of the organisms. Physicochemical characteristics are similar in the lake, except at station 8 where the lowest dissolved oxygen levels, highest ammonia and phosphorus concentrations were registered. This area, adjacent to a fish processing plant, is affected by domestic and industrial wastewater discharges. The results show that up to the present the lake has been moderately polluted, but critical zones exist that restrict the use of the lake for water supply and recreational purposes. (Author's abstract)
W86-01608

STRIPPING ANALYSIS AND CHROMATOGRAPHIC SNIFFING FOR THE SOURCE IDENTIFICATION OF ODOROUS COMPOUNDS IN DRINKING WATER,
Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society.
For primary bibliographic entry see Field 7B.
W86-01696

ANALYSIS OF VARIANCES AS DETERMINED FROM REPLICATES VS. SUCCESSIVE SAMPLING,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W86-01698

USE OF IONIC MIXING CURVES IN DIFFERENTIATING OIL FIELD BRINE FROM NATURAL BRINE IN A FRESH WATER AQUIFER,
Oklahoma State Univ., Stillwater. Dept. of Civil Engineering.
V. A. Mast.
Ground Water Monitoring Review, Vol. 5, No. 3, p 65-69, Summer, 1985. 5 Fig, 2 Tab, 4 Ref.

Descriptors: *Pollutant identification, *Brines, *Saline water intrusion, Dissolved solids, Chlorides, Statistical studies, Model studies, Water pollution sources.

The study and analytical technique used to determine the relative contribution of various pollution sources to the increased salinity of the fresh water aquifer in the south Wichita, Kansas area were investigated. A statistical model is presented which has proven to be a valuable tool in determining the percentage contribution of pollution from the various sources of contaminants. For the most reliable factors, chloride and total dissolved solids, the volumetric percentage contribution of oil field brine and Wellington Formation natural brine at the bottom of the aquifer ranged from 6.5% to 8.5% and 6.8% to 7.1%, respectively. For the analytical model itself, two drawbacks are pointed out. First, the water system in the model is highly simplified. For a system with more than two potential pollutant sources, this analysis will not serve a proper function. Second, the choice of factor pairs is site dependent. With different geological environments, as well as different pollutant types, the factor pairs used must be chosen accordingly. Three suggestions are made for future analysis in multisource pollution systems: for the unsteady-state system, a time factor should be included in the analysis; for a system of N number of pollutant sources, factor group of N items should be used for analysis; and every item in the factor group selected should represent the characteristics of the respective pollutant sources. (Baker-IVI)
W86-01699

GROUND WATER QUALITY ANOMALIES ENCOUNTERED DURING WELL CONSTRUCTION, SAMPLING AND ANALYSIS IN THE ENVIRONS OF A HAZARDOUS WASTE MANAGEMENT FACILITY,
Woodward-Clyde Consultants, Walnut Creek, CA. Environmental and Engineering Services.
D. Dunbar, H. Tuchfeld, R. Siegel, and R. Sterbentz.
Ground Water Monitoring Review, Vol. 5, No. 3, p 70-74, Summer, 1985. 1 Fig, 3 Tab, 1 Ref.

Descriptors: *Water quality, *Monitoring, *Well construction, Construction, Wells, Hazardous waste, Hydrogeology, Waste disposal, Aquifer characteristics, Potentiometry, Tetrahydrofuran, Trihalomethanes, Organic compounds, Water pollution sources.

The occurrence of a number of ground water quality anomalies during field investigations demonstrates the need for careful attention to specialized well construction, sampling and analytical procedures. The specific anomalies and their corresponding causes include elevated pH values due to poor well construction procedures; the presence of tetrahydrofuran, caused by the use of glue at casing joints; the temporary occurrence of trihalomethanes produced during the breakdown of synthetic drilling fluid; and cross contamination of groundwater samples due to incomplete equipment decontamination procedures. (Baker-IVI)
W86-01700

REDUCTION OF HEXAVALENT CHROMIUM IN WATER SAMPLES ACIDIFIED FOR PRESERVATION,
Geological Survey, Denver, CO.
K. G. Stollenwerk, and D. B. Grove.
Journal of Environmental Quality, Vol. 14, No. 3, p 396-399, 1985. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Chromium, *Sample preservation, *Hexavalent chromium, Water chemistry, Preservation, Chemical reactions, Hydrogen ion concentration, Nitrates, Organic carbon, Water temperature.

Reduction of hexavalent chromium, Cr(VI), in water samples, preserved by standard techniques, was investigated. The standard preservation technique for water samples that are to be analyzed for Cr(VI) consists of filtration through a 0.45-micro-m membrane, acidification to a pH < 2, and storage in plastic bottles. Batch experiments were conducted to evaluate the effect of H(+) concentration, NO2, temperature, and dissolved organic carbon (DOC) on the reduction of Cr(VI) to CR(III). The rate of reduction of Cr(VI) to Cr(III) increased with increasing NO2, DOC, H(+), and temperature. Reduction of Cr(VI) by organic matter occurred in some samples even though the samples were unacidified. Reduction of Cr(VI) is inhibited to an extent by storing the sample at 4 C. Stability of Cr(VI) in water is variable and depends on the other constituents present in the sample. Water samples collected for the determination of Cr(VI) should be filtered (0.45-micro-m membrane), refrigerated, and analyzed as quickly as possible. Water samples should not be acidified. Measurement of total Cr in addition to Cr(VI) can serve as a check for Cr(VI) reduction. If total Cr is greater than Cr(VI), the possibility that Cr(VI) reduction has occurred needs to be considered. (Author's abstract)
W86-01713

ESTIMATING ALGAL AVAILABLE PHOSPHORUS IN SUSPENDED SEDIMENTS BY CHEMICAL EXTRACTION,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
R. A. Dorich, D. W. Nelson, and L. E. Sommers.
Journal of Environmental Quality, Vol. 14, No. 3, p 400-405, 1985. 1 Fig, 3 Tab, 31 Ref.

Descriptors: *Phosphorus, *Algae, *Suspended sediments, *Chemical analysis, *Extraction, Sediments, Bioavailability, Nutrients, Cycling nutrients.

The availability of sediment inorganic phosphorus (P sub i) to algae was determined in 28 suspended stream sediments collected from an agricultural watershed in northeastern Indiana by short (2-d) and longer-term (14-d) incubations. Unincubated sediment was also analyzed for dissolved molybdate reactive P sub i (DMRP) and P sub i extracted by: (i) sequential NaOH and HCl, (ii) sequential NH4F, NaOH, and HCl, (iii) nitrilotriacetic acid (NTA), (iv) hydroxy-Al resin, and (v) total P. Available P (P sub aa) measured in sediments by 2-d and 14-d incubations with algae averaged 21 and 25% of total sediment P, respectively. Extraction of sediments with 0.1 M NaOH, 0.5 M NH4F, sequential 0.5 M NH4F + 0.1 M NaOH, NTA, and hydroxy-Al resin removed an average of 36, 22, 31, 45, and 17% of the total P, respectively. Of the extractants tested, NaHO-extractable P sub i was significantly correlated with 2-d and 14-d P sub aa ($r = 0.89^{***}$ and 0.95^{***}, respectively) but NaOH extraction removed amounts of P sub i that exceeded sediment P sub aa by a relatively constant amount. The results suggest that a single extraction with 0.1 M NaOH can be used to estimate both short- and longer-term P sub aa in suspended stream sediments derived from noncalcareous soils in the Northcentral USA. (Author's abstract)
W86-01714

DETERMINATION OF POTASSIUM, SODIUM, CALCIUM, AND MAGNESIUM IN NATURAL WATERS BY ION CHROMATOGRAPHY,
Iowa State Univ., Ames. Dept. of Agronomy.
N. T. Basta, and M. A. Tabatabai.
Journal of Environmental Quality, Vol. 14, No. 3, p 450-455, 1985. 4 Fig, 5 Tab, 20 Ref.

Descriptors: *Potassium, *Sodium, *Calcium, *Magnesium, *Chemical analysis, *Ion chromatography, Chromatography, Conductimetric detection, Metals, Iron.

Simultaneous determination of alkali and alkaline earth metals in water samples is needed. Studies to evaluate the Dionex Model 10 Ion Chromatograph (IC) for simultaneous determination of K and Na or Ca and Mg in diverse types of natural waters, including soil extracts, showed that the results by the IC method closely agreed with those obtained by flame photometry for K and Na and by atomic absorption spectrophotometry of K, Na, Ca, and Mg. The IC method is based on separation of the monovalent and divalent cations by a separator column containing a low-capacity sulfonated divinylbenzene polystyrene copolymer, cation-exchange resin in the H(+) form and on converting the various metal ions to their corresponding hydroxides by a suppressor column containing a high-capacity, anion-exchanged resin in the OH(-) form. The eluent used for determination of alkali metals was 5 mM HCl, and a solution containing 2.5 mM HCl + 2.5 mM m-phenylenediamine dihydrochloride was used for determination of alkaline earth metals. Electrical conductivity is used as the mode of detection. The method is precise, accurate, and can detect as little as 0.1 mg/L of K, Na, Ca, or Mg in water samples. The coefficient of variation values ranged from 1.3 to 5.0% for K, from 0.63 to 9.1% for Na, from 1.9 to 3.5% for Ca, and from 0 to 24% for Mg. With the IC method, K and Na or Ca and Mg can be determined simultaneously in 2 mL of water in approximately 7 min. A single operator can perform about 40 analyses of alkali or alkaline earth metals in a normal working day. Successive analyses of waters containing high concentrations of metals (e.g., Fe) may lead to loss of resolution of alkali metals, but this can be restored by washing the separator column with 3 M HCl saturated with EDTA. (Author's abstract)
W86-01717

PRECONCENTRATION AND X-RAY SPECTROMETRIC DETERMINATION OF ARSENIC(III/V) AND CHROMIUM(III/VI) IN WATER,
Link Systems Ltd., High Wycombe (England).
D. E. Leyden, K. Goldbach, and A. T. Ellis.
Analytica Chimica Acta, Vol. 171, p 369-374, 1985. 2 Fig, 4 Tab, 5 Ref.

Descriptors: *Pollutant identification, *Spectrometry, *Arsenic, *Chromium, Water analysis, Chemical analysis, Speciation.

Two precipitation methods have been used successfully to determine chromium and arsenic in their respective oxidation states in water samples. The DBDTC (dibenzyldithiocarbamate) precipitation method recovers Cr(VI) and As(III) selectively over Cr(III) and As(V) as a first precipitation step. The remaining Cr(III) and As(V) are quantified in a second step by coprecipitation with hydrated iron(III) oxide. Sensitivity is higher for chromium and arsenic by the DBDTC method because of increased matrix absorption for iron(III) in the coprecipitated samples. The method will likely not supplant atomic absorption or inductively coupled plasma emission spectrometry for accuracy and precision, but it does provide speciation information and a fast economical method. Standards can be stored indefinitely. (Baker-IV)
W86-01719

ZIRCONIUM COPRECIPITATION FOR SIMULTANEOUS MULTIELEMENT DETERMINATION OF TRACE METALS IN SEAWATER BY INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY,
Tokyo Univ. (Japan). Dept. of Chemistry.
T. Akagi, Y. Nojiri, M. Matsui, and H. Haraguchi.
Applied Spectroscopy, Vol. 39, No. 4, p 662-667, 1985. 3 Fig, 5 Tab, 38 Ref.

Descriptors: *Zirconium, *Coprecipitation, *Precipitation, *Chemical analysis, *Seawater, *Inductively Coupled Plasma Atomic Emission Spectrometry, *Trace metals, Metals, Preconcentration, Spectroscopy, Atomic emission spectrometry, Inductively coupled plasma.

Zirconium coprecipitation for simultaneous multielement determination of trace metals in seawater has been examined by inductively coupled plasma atomic emission spectrometry. Optimum pH conditions and other experimental procedures for coprecipitation were investigated in order that the method for multielement preconcentration could be evaluated. The concentration factor of 20 times the original concentration was obtained, although it was limited by spectral interference with zirconium. The present coprecipitation method improved the detection limits and other analytical figures of merit for 17 trace metals (Al, As, Cd, Co, Cr, Cu, Fe, La, Mn, Mo, Ni, Pb, Sb, Ti, V, Y, and Zn), which were estimated by the use of artificial seawater samples, and it was applied to natural seawater analysis. (Author's abstract)
W86-01720

ATTENUATION VERSUS TRANSPARENCY,
Upstate Freshwater Inst., Inc., Syracuse, NY.
S. W. Effler.
Journal of Environmental Engineering, Vol. 111, No. 4, p 448-459, August, 1985. 5 Fig, 1 Tab, 33 Ref.

Descriptors: *Light attenuation, *Transparency, *Secchi disks, Downwelling irradiance, Absorption, Scattering, Solar radiation, Physical properties, Physicochemical characteristics.

The differential response of the two commonly used measures of light penetration in water, Secchi disc transparency (SD, m) and the attenuation coefficient for downwelling irradiance (Kd, per m), to the light attenuating processes of absorption and scattering is described. The commonly invoked constancy in the product Kd x SD should c expected when the relative contributions c tering and absorption of Kd remains unifc number of scenarios and documented phen are presented for which preferential effe scattering or absorption, and therefore v values of Kd x SD, are expected. Measu errors also contribute to variability in Kd particularly at low (< 1.5 m) SD values. observations of Kd and SD presented fro different systems, representing a wide range and SD values, demonstrate the variability magnitude of Kd x SD within individual s Secchi disc transparency is probably not a indicator of Kd in many systems. The unce associated with invoking the constancy of SD in various ecological modeling effo which Kd measurements are missing or are rally limited, should be accommodated. (A abstract)
W86-01725

DETERMINATION OF METHYLMER BY PHASE-SENSITIVE A.C. POLARO PHY,
Institutul Politehnic din Bucuresti (Ro
Dept. of Analytical Chemistry.
I. Ioneci, I. Tanase, and C. Luca.
Analytical Letters, Vol. 18(A8), p 929-945 1985. 6 Fig, 64 Ref.

Descriptors: *Methylmercury, *Polaro Pollutant identification, Mercury compoun ganic compounds, Water analysis.

Direct determination of organically-bound ry in water is very difficult because of th volatility of the organomercury compou method is described for the determination o ylmercury in water using polarography. The ographic reduction of methylmercury in a medium takes place in two steps, each of involves the transfer of a single electron. T reduction step proceeds reversibly both in current and in sinusoidal alternating curren Since the polarograms corresponding to th are well defined, they can be successfully determine methylmercuric compounds by sensitive sinusoidal a.c. polarography, in th centration range 1 x 10 to the minus 7th pov x 10 to the minus 4th power mole/cu dm. sensitive sinusoidal a.c. polarography offers vantageous way of determining methylmer the presence of inorganic mercury and also presence of other forms of organically- mercury, especially of phenylmercury, an tage not offered by any other known an technique. (Moore-IVI)
W86-01755

COPPER AND SILVER ACCUMULATI TRANSPLANTED AND RESIDENT C (MACOMA BALTHICA) IN SOUTH FRANCISCO BAY,
Geological Survey, Menlo Park, CA.
D. J. Cain, and S. N. Luoma.
Marine Environmental Research, Vol. 15, 135, 1985. 7 Fig, 1 Tab, 45 Ref.

Descriptors: *Copper, *Silver, *Clams, *B mulation, Bioindicators, Heavy metals, Wa lution effects, San Francisco Bay, California

Accumulation of Cu and Ag by soft tissues deposit-feeding clam Macoma balthica w than half in clams transplanted to a contar area than in clams native to that area. D period of tissue growth, the transplants r 50% and 90%, respectively, of the net Cu accumulated, but loss of metals from soft ti the resident population equalled net accum Copper accumulation in the transplants o occur during some periods when increases metal body burden of the resident populati cated that environmental exposures were hi difference in metal accumulation of the two of clams may be the result of past enviro exposures. The results illustrate some limita using transplant as indicators of pollution ev

ant impact upon resident populations. (Au-
stract)
93

OF SEAWATER MAGNESIUM ON
AL FLUORESCENCE DURING ESTUA-
MIXING, AND IMPLICATIONS FOR
APPLICATIONS,
Carolina Univ. at Wilmington. Div. of
y.
ary bibliographic entry see Field 2L.
01

MINATION OF ZINC, CADMIUM,
ND COPPER IN PRECIPITATION BY
TERIZED DIFFERENTIAL PULSE
IMETRY,
ds Energy Research Foundation ECN,

gerak, A. M. v. Wensveen-Louter, and J.

nal Journal of Environmental Analytical
, Vol. 19, p 85-98, 1985. 6 Fig, 3 Tab, 13

rs: *Chemistry of precipitation, *Zinc,
, *Lead, *Copper, *Differential pulse
try, Voltammetry, Heavy metals, Chemi-
sition, Computers.

is described for the determination of
rainwater by means of differential pulse
pping voltammetry. Organic interferants
ed by passing the sample over active
pH < or = 1. A symmetrical, mercury-
rode flow through cell is mounted on a
electrode stand. The polarography and
jection sample handling system are com-
rolled. Results are obtained by means of
n graph, standard additions are not nec-
ults for Zn, Cd, Pb and Cu in rainwater
eement with results obtained by AAS.
bstract)

NATION OF COMMON ANION
RATIONS IN SURFACE AND
WATER SAMPLES BY ELUENT-
SED ION CHROMATOGRAPHY,
ergy of Canada Ltd., Chalk River (On-
k River Nuclear Labs.
nd J. M. Judd.
l Journal of Environmental Analytical
Vol. 19, p 99-109, 1985. 3 Fig, 7 Tab,

: *Ion chromatography, *Eluent sup-
Anions, *Chemical composition, Fluo-
de, Phosphates, Nitrates, Sulfates, Nat-
Surface waters, Groundwater.

ion chromatography with eluent sup-
articularly suited to determine concen-
F(-), Cl(-), PO4(-3), NO3(-) and SO4(-2)
urface and ground water samples. An
system using hollow-fiber suppressors
ed. All anions yield linear responses
ighest concentrations and the relative
viation is <3% in all determinations
lowest F(-) and Cl(-) concentrations.
recision for both standard anion solu-
mples is similar. Peak height and peak
cation are compared and the effects of
ontent, pH, storage and filtration on
lysis are determined. Recalibraton,
dard anion solution inserted at every
n on the auto sampler holding tray,
d maintains analytical precision. Reca-
essential if high precision is sought in
ion chromatography with eluent sup-
oore-IVI)

ATION OF NONIONIC SURFAC-
VATER BY ATOMIC ABSORPTION
ETRY,
Waterwerken (Belgium).
oof, W. J. Van Craenenbroeck, and J.

International Journal of Environmental Analytical Chemistry, Vol. 19, p 155-164, 1985. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Surfactants, *Atomic absorption spectrometry, Sublation, Ion exchange, Pollutant identification, River Meuse, France, Belgium, Netherlands.

An analytical method for nonionic surfactants has been developed using sublation and ion-exchange for isolation of the surfactants and complex formation with potassium zinc tetrathiocyanate followed by atomic absorption spectrophotometric assay of zinc released from the complex through acid extraction. The detection limit for this method is 0.01 mg/l Triton X-100. Recoveries higher than 90% were obtained starting from samples spiked with 0.1 mg/l Triton X-100. The method has been applied to 70 surface water samples coming from a quality survey of the River Meuse in France, Belgium and The Netherlands organized by the RIWA-Cooperating Rhine and Meuse Water Supply Companies. The highest level (0.50 mg/l) was found below the outfall of a surfactant-producing firm. Downstream these discharge levels decreased rapidly. (Author's abstract)
W86-01848

VARIABILITY OF ALUMINUM CONCENTRATIONS IN ORGANS AND WHOLE BODIES OF SMALLMOUTH BASS (MICROPTERUS DOLOMIEUI),
Columbia National Fisheries Research Lab., MO.
W. G. Brumbaugh, and D. A. Kane.
Environmental Science and Technology, Vol. 19, No. 9, p 828-831, 1985. 6 Tab, 20 Ref.

Descriptors: *Aluminum, *Bass, Metals, Pollutant identification, *Fish, Atomic absorption spectrophotometry, Gills, Water pollution effects, Animal tissues.

Variability of aluminum concentrations in smallmouth bass (Micropterus dolomieui) was evaluated by analysis with graphite furnace atomic absorption spectrophotometry. Fish analyzed as whole bodies were compared to fish which had selected organs analyzed individually and separately from the carcass. Gastrointestinal tract contents contained highly variable amounts of aluminum and caused bias and increased variability when included in whole-body samples. Since aluminum concentrations in tissues of stomach and intestine were similar to those in the whole body (less gastrointestinal tract contents), the entire gastrointestinal tract and contents could be removed to reduce bias and variability without measurably altering the 'true' whole-body aluminum concentrations. Of the organs analyzed, gill filaments had the highest and most variable aluminum concentrations and may have contributed to within-fish whole-body variability because of incomplete homogenization. (Author's abstract)
W86-01872

BIOCONCENTRATION FACTORS OF SOME HALOGENATED ORGANICS FOR RAINBOW TROUT: LIMITATIONS IN THEIR USE FOR PREDICTION OF ENVIRONMENTAL RESIDUES,
National Water Research Inst., Burlington (Ontario). Environmental Contaminants Div.
For primary bibliographic entry see Field 5C.
W86-01874

FRESHWATER AQUATIC MACROPHYTES AS HEAVY METAL MONITORS - THE OTTAWA RIVER EXPERIENCE,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
D. C. Mortimer.
Environmental Monitoring and Assessment, Vol. 5, No. 3, p 311-323, September, 1985. 2 Fig, 7 Tab, 15 Ref.

Descriptors: *Macrophytes, *Heavy metals, Monitoring, Seasonal variation, Plant growth, Lead, Mercury, Nickel, Copper, Aquatic plants, Ottawa River.

The ability of freshwater aquatic vascular plants to accumulate heavy metals was examined in some detail during a five year study. Differences in uptake rate were found to depend on the species of plant, the seasonal growth rate changes and the metal ion being absorbed. Lead and mercury were concentrated to a greater extent than the lighter nickel and copper. Laboratory experiments were designed to establish uptake rate constants which were used to calculate water concentrations of mercury from the analyses of plant samples from the river. 'Background' levels of mercury in aquatic plants of 35-50 ng/L dry weight corresponded to a water concentration near 15 ng/L of total mercury of which 25-30% was methyl-mercury. Higher concentrations of mercury in the plants indicated a proportional increase in the mercury level in the water. (Author's abstract)
W86-01887

AVOIDANCE TEST OF A FISH, MEDAKA (ORYZIAS LATIPES), TO AQUATIC CONTAMINANTS, WITH SPECIAL REFERENCE TO MONOCHLORAMINE,
Ehime Univ., Matsuyama (Japan). Dept. of Environment Conservation.
H. Hidaka, and R. Tatsukawa.
Archives of Environmental Contamination and Toxicology, Vol. 14, No. 5, p 565-571, September, 1985. 4 Fig, 1 Tab, 22 Ref.

Descriptors: *Fish behavior, *Monochloramine, *Avoidance, Medaka, Bioindicators, Toxicity, Chlorine, Surfactants, Residual chlorine, Chloramines, Water pollution effects.

The avoidance behavior of fish is a sensitive indicator for aquatic contaminants such as surfactants, pesticides, and residual chlorine. A monochloramine avoidance test was carried out using medaka (Oryzias latipes) in a small modular chamber system with a symmetrical parallel-flow. In the apparatus, the diluted toxicant solution and the control water run parallel with a distinct boundary at the center of the chamber. The significant avoidance concentration (P = 0.05) was 5.7 micro-g/L as combined residual chlorine, which is the lowest residual chlorine avoidance concentration reported in the literature. The avoidance curves for monochloramine exhibited a pattern similar to those for anionic surfactants. As the avoidance behavior of fish is a sensitive indicator, this avoidance test may be used as one of the standard methods for ecotoxicological studies. (Moore-IVI)
W86-01888

COLORIMETRIC DETERMINATION OF PROPOXUR RESIDUES IN VEGETABLES AND WATER,
Central Food Technological Research Inst., Mysore (India). Analytical Quality Control Lab.
K. M. Appaiah, M. A. Sreenivasa, and O. P. Kapur.
Bulletin of Environmental Contamination and Toxicology, Vol. 296-300, September, 1985. 2 Tab, 17 Ref.

Descriptors: *Propoxur, *Insecticides, *Colorimetry, India, Pollutant identification, Water analysis, Pesticide residues.

Propoxur is a non-systemic insecticide used on a large scale in India on field crops. Although gas and liquid chromatographic methods are ideal for detecting and quantifying propoxur residues their use is often limited by availability and cost of equipment. The advantages of the colorimetric method proposed are that it does not require elaborate clean-up technique, gives high recovery, produces a stable color and is as sensitive as the method which uses 4,4-diaminodiphenyl sulfone as the chromogenic reagent. The phenol obtained after alkaline hydrolysis of propoxur is treated with concentrated nitric and sulfuric acids to get nitrosophenol which is in the presence of excess of alcoholic ammonium hydroxide rearranges to form a highly colored quinoid salt. The color is stable for weeks. To check the adequacy of the method, water and vegetable samples were fortified with known amounts of propoxur and analyzed. Recov-

eries ranged from 95.1 to 98.0% for water samples, and 93.5 to 97.8% for vegetable samples. (Baker-IVI)
W86-01895

DAPHNIA MAGNA AS AN INDICATOR OF THE ACUTE TOXICITY OF WASTE WATERS,
National Board of Waters, Helsinki (Finland). Water Research Inst.
E. Nikunen, and V. Miettinen.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 368-374, September, 1985. 1 Tab, 21 Ref.

Descriptors: *Daphnia, *Toxicity, *Wastewater disposal, *Water pollution effects, *Bioindicators, Indicators, Zooplankton, Pulp wastes, Pulp and paper industry, Industrial wastewater.

The proposed Finnish standard for both chemical and wastewater testing is described and results obtained with different industrial wastewaters using the test method are presented. The wastewater samples taken for the experiments were mainly chosen by the local water authorities. The majority of the tested effluents were taken form the pulp and paper industry, which is the most important polluter of the Finnish waters. The tests conducted on Daphnia magna indicated that the proposed Finnish standard is a fairly rapid and easy method for measuring the acute lethal toxicity of waste water samples. Pulp and paper mills had clearly the biggest toxicity emission rates of the samples investigated. Just one other plant, producing viscose fibers, had a TER (toxicity emission rate) value which was in the same order of magnitude as the median values of wastewaters released from different pulp producing plants. (Baker-IVI)
W86-01905

MONITORING OF POLYCHLORINATED BIPHENYLS (PCBS) AND HEXCHLOROCYCLOHEXANES (HCH) IN FRESHWATER USING THE AQUATIC MOSS CINCLIDOTUS DANUBICUS,
Metz Univ. (France). Lab. d'Ecologie.
C. Mouvet, M. Galoux, and A. Bernes.
Science of the Total Environment, Vol. 44, p 253-267, 1985. 2 Fig, 6 Tab, 64 Ref.

Descriptors: *Monitoring, *Polychlorinated biphenyls, *Hexachlorocyclohexanes, *Mosses, *Bioindicators, Indicators, Organic compounds, Water pollution effects, Fate of pollutants, Pesticides.

The use of aquatic bryophytes for the monitoring of polychlorinated biphenyls (PCBs) and chlorinated pesticides alpha-, beta-, and gamma-HCH in freshwaters was investigated. Concentrations of alpha- and beta-HCH in Cinclidotus danubicus from the Saone (France) were below the detection limit. The contamination of the mosses by gamma-HCH did not vary much along the course of the river even though the site farthest downstream appeared less contaminated than the three other sites located in more agricultural areas. Polychlorinated biphenyls were detected at the four sites studied with no significant variation along the course of the river. Concentations of alpha-, beta- and gamma-HCH in water samples from Les Mees, 4 km downstream from a discharge site indicate the extreme contamination of the Durance. Polychlorinated biphenyl concentrations were below the detection limit. A progressive increase in the contaminant concentrations in C. danubicus transplanted to the polluted stretch of the river was observed. Polychlorinated biphenyls were detected in all moss samples with slight variations between sites and no significant change as a function of time. (Baker-IVI)
W86-01916

5B. Sources Of Pollution

INDICATORY ROLE OF SOME INVERTEBRATES FOR QUALITY OF WATER IN THE VISTULA RIVER AND IN SUBSEQUENT STAGES OF ITS TREATMENT,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
For primary bibliographic entry see Field 5A.
W86-01327

OCCURRENCE AND TRANSPORT OF ORGANIC MACROCONTAMINANTS IN THE DULUTH-SUPERIOR HARBOR,
Wisconsin Univ.-Superior. Center for Lake Superior Environmental Studies.
D. A. Bahnick, and T. P. Markee.
Journal of Great Lakes Research, Vol. 11, No. 2, p 143-155, 1985. 2 Fig, 7 Tab, 29 Ref. Dept. of Commerce grant NA 800AA-D-00086.

Descriptors: *Fate of pollutants, *Duluth-Superior Harbor, *Great Lakes, *Organic compounds, Pollutant transport, Lake sediments, Suspended sediments, Polychlorinated biphenyls, Aromatic hydrocarbons, Pentachlorophenol.

The Duluth-Superior harbor is a major Great Lakes port serving about 10,000 commercial and recreational vessels annually. The nature and magnitude of certain organic microcontaminants associated with harbor sediments and suspended particulate matter subject to transport to Lake Superior were investigated. The microcontaminants included polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH), and pentachlorophenol (PCP). The results of initial screening of particulate samples obtained from Duluth harbor in 1980 identified about 200 compounds in four extract fractions. The compound types consisted mainly of hydrocarbons, organic acids, esters, and alcohols. In addition some amines, ketones, aldehydes and phenols were detected. These compounds appear to be primarily plant decomposition products. GC/MS analysis in 1982 suggests the presence of a very large number of compounds, particularly in sediment sample extracts. Most appear to be naturally occurring organics. Some PAH compounds were also identified. Dichlorobenzene was the only halogenated compound identified from this data. In 1983, particulates were sampled in yet another site. Five PAH compounds were identified by retention times. PCP was detected in sediments and particulates collected from sites 1 and 2 in Duluth Harbor in 1982. Particulate samples contained higher concentrations of PCBs than did sediments. This may be due to a larger surface area and a higher organic content. Considering the concentration of PCBs in water and particulates in conjunction with average suspended solids levels, it was calculated that 91% of the PCBs were dissolved in water and 19% associated with suspended particles. Suspended solid transport of PCBs and PAH to Lake Superior is less than 0.01% of airborne transport. (Baker-IVI)
W86-01346

ANTHROPOGENIC, POLYHALOGENATED, ORGANIC COMPOUNDS IN SEDENTARY FISH FROM LAKE HURON AND LAKE SUPERIOR TRIBUTARIES AND EMBAYMENTS,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
R. Jaffe, E. A. Stemmler, B. D. Eitzer, and R. A. Hites.
Journal of Great Lakes Research, Vol. 11, No. 2, p 156-162, 1985. 1 Fig, 2 Tab, 26 Ref. EPA grant R005737-01.

Descriptors: *Organic compounds, *Halogenated hydrocarbons, *Fish, *Water pollution sources, Lake Huron, Lake Superior, Great Lakes, Tributaries, Industrial wastes, Fate of pollutants, Pesticides, DDT.

Analyses were made on composite samples of fish taken from some of the major tributaries and embayments of Lake Superior and Lake Huron for halogenated xenobiotics. A good correlation was noted between the areas of industrial and urban development and the abundance, as well as variety, of industrial pollutants and pesticides in fish. Findings suggest that Saginaw Bay acts like a sink for pollutants from the area, especially for very hydrophobic compounds that are associated with suspended matter. The major source for PBBs seems to be located around the Pine River and Chippewa River areas, while PCBs are more abundant Chippewa, Tittabawassee, and Flint River PCTs seems to have sources near the Fli Saginaw rivers and, surprisingly, in the Kew Bay area. A similar pattern was noted f PCDEs except that they were also found Chippewa and Tittabawasee rivers but not Keweenaw Bay. It is interesting to note th concentrations of total DDTs in the Pine and Chippewa Rivers fish, as well as the pr of DDT itself in Pine River fish, indica possible source for these chemicals. (Bak
W86-01347

ACIDIFICATION OF GEORGIAN BAY RI ESTIMATED BY MODIFICATIONS OF WRIGHT-HENRIKSEN MODEL,
Department of Fisheries and Oceans, Owen (Ontario). Great Lakes Fisheries Research B
M. G. Johnson.
Journal of Great Lakes Research, Vol. 11, N 163-170, 1985. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *Georgian Bay, *Ontario, *F pollutants, *Acidification, Acid rain, Alk Mathematical models, Anions, Organic pounds, Sulfates, Hydrogen ion concentratio

Major ion composition of fresh waters can b to estimate temporal changes in alkalinity a caused by loadings of sulfuric acid from the phere. In the Georgian Bay rivers organic must be considered, but road salt additio considerably more important than minor inputs. Nineteen rivers tributary to Georgia Lake Huron were sampled at the time of freshet in 1980-1983, and modified versions Henriksen-Wright model were used to m acidifiication of these river systems by esti loss of alkalinity and sulfate concentrations background sulfate levels. Spring freshet da used to assess acidification at times of e conditions, which likely are of more signific aquatic life. While seasonal variations in ac tion have not been examined, springtim charges should be more representative of th fication stress on these systems. Alkalini mates, averaged for all rivers, were 107-147 eq/L for various modifications and net sulfa mates averaged 108-125 micro-eq/L. Both ures of acidification increased with proxi Sudbury. The decrease in alkalinity, 45-166 eq/L for the 19 rivers, was related to the variability in atmospheric acid loadings, wi pH decrease, 0.2-1.6 units, reflected as w original buffering of each river. Organic were important in achieving cation-anion ba in interpretation of pH, and in modification Wright-Henriksen model. (Baker-IVI)
W86-01348

TIME-DEPENDENT SOLUTION OF M SEGMENT MASS BALANCE MODEL CONTAMINANTS IN THE GREAT LAKE
Argonne National Lab., IL. Environmen search Div.
B. M. Lesht.
Journal of Great Lakes Research, Vol. 11, N 182-189, 1985. 3 Fig, 5 Tab, 21 Ref.

Descriptors: *Phosphorus, *Mass balance, Lakes, Seasonal variations, Linear progra Model studies, Fate of pollutants, Lakes.

The application of the time-dependent m ment mass balance model to the phosphor ance of the Great lakes is one example of th of the technique. Simple mass balance mo widely used for a variety of purposes but ar restricted by the assumption of steady sta though this assumption reduces the amoun formation required by the models it also lim information provided by the models. Form the model in time-dependent terms require input information but also provides more output. The choice between the two form will depend on the purpose for which the m developed. In the case of a model being dev as a synthesis of present understanding of a cated environmental system, the time-dep

ment mass balance model can be a valua-
The time dependent solution may be used
te year to year variations in the system
to time variable forcing, or to determine
certainty due to temporal variation in the
efficients. (Baker-IVI)
50

**PHERIC SULFUR DIOXIDE AND
TER AT A COASTAL LOCALITY IN
GLAND,**
l Univ. (England). Dept. of Geography.
rfe, and P. A. James.
ir, and Soil Pollution, Vol. 25, No. 3, p
uly, 1985. 3 Fig, 3 Tab, 6 Ref.

rs: *Sulfates, *Rain, *England, North
e, Hydrogen ion concentration, Acid
r pollution sources, Sulfur dioxide.

onship between atmospheric sulfur diox-
ntrations and rainwater pH is examined
al locality in North Merseyside, England
riod 1978 to 1982. There were appreciа-
nces between pH values for the sampling
e was no seasonal pattern in pH which is
for all the years, though a tendency does
a summer maximum. Sulfate shows a
inter maximum. pH correlated signifi-
h time as measured through the 1978 to
d. The Merseyside regional average sul-
declined markedly during the 1960's, the
cline decreasing in the mid-1970's. The
f acidity in the rainwater between 1978
s noted. Over this same period local
els have decreased slightly. The signifi-
ng range pollutant transport is recog-
here is evidence to suggest that sulfate
ons at Formby are related to wind fre-
d wind run from the direction of the
and Manchester conurbations. (Baker-

**L OF BACILLUS THURINGIENSIS
STAKI IN WATERS,**
ntal Protection Service, Dartmouth
ia).
n, and J. de Mestral.
and Soil Pollution, Vol. 25, No. 3, p
y, 1985. 4 Fig, 2 Tab, 13 Ref.

: *Bacillus thuringiensis, *Nova Scotia,
s, Pesticides, Bacteria, Biocides, Path
s, Drinking water, Chlorination.

ner of 1979 and 1980, the Nova Scotia
ands and Forests conducted a pilot
ct on the use of Bacillus thuringiensis
i for the control of spruce budworm
n Nova Scotia. Field and laboratory
conducted to assess the survival of B.
aki in waters. Lab studies showed that
rstaki can survive in fresh water and
r more than 70 and 40 days, respective-
. A higher percentage of B. t. var.
found surviving in lake water than in
tilled water for an extended period,
e to the presence of more available
lake water for growth. B. t. var. kur-
ound in the Parrsboro water sytem
pray study, raising the suspicion that
of residual Cl normally applied to
rinking water supplies might not be
kill B. t. var. kurstaki. This is support-
ults of the laboratory studies that high
tions, 1.5 to 2.0 mg/L, and long con-
to 60 min, are needed to inactivate B.
ki completely. (Baker-IVI)

**ECIPITATION AND SURFACE-
LNERABILITY ON THE WESTERN
THE HIGH COLORADO ROCKIES,**
niv., Berkeley. Energy and Resources
P. Lockett, R. A. Schneider, H.
l C. Blanchard.
nd Soil Pollution, Vol. 25, No. 3, p
, 1985. 2 Fig, 2 Tab, 16 Ref. DOE

contract DE-AC03-76SF00098.

Descriptors: *Rocky Mountains, *Colorado, *Acid rain, Alkalinity, Rainfall, Alpine lakes, Watersheds, Hydrogen ion concentration.

Increased fossil fuel consumption in California, the Great Basin, or the upper or lower Colorado River drainage regions could lead to increased acidity of precipitation in the Rockies. The occurrence of acid precipitation at a remote and sensitive location in the Colorado Rockies brought about a long term study of the precipitation and surface waters of the western slope. The site is distant from highways, point sources, and major urban areas, and receives consistently acidic precipitation. The resulting data provide a means of assessing the present sensitivity of watersheds in the region to acidification and ultimately will allow determination of trends. The volume-weighted average pH for summer events was 4.61, for winter events was 5.11 and for the entire period was 4.91. Within the watershed, both low- and medium-alkalinity surface waters exist. Weekly alkalinity measurements ranged from 10 to 70 micro-eq/l in the former and 100 to 900 micro-eq in the latter. The findings demonstrate the occurrence of acid precipitation and the susceptibility to acidification of alpine lakes in this area. (Baker-IVI)
W86-01356

PARTITIONING OF HEAVY METALS (FE, MN, CD, PB, CU, ZN, CO, NI AND AS) AND P INTO SELECTIVE CHEMICAL FRACTIONS IN SEDIMENTS FROM LAKE KOJIMA (IN JAPANESE),
S. Nakashima, M. Yagi, and I. Aoyama.
Nogaku Kenkyu, Vol. 60, No. 4, p 157-169, March, 1985. 12 Fig, 13 Ref.

Descriptors: *Lake Kojima, *Okayama Prefecture, *Japan, *Lake sediments, *Heavy metals, *Phosphorus, Iron, Manganese, Cadmium, Cadmium, Lead, Copper, Zinc, Cobalt, Nickel, Arsenic, Metals, Nutrients, Particle size, Clays, Organic matter, Silicates, Sulfides.

To investigate the mechanism of metal accumulation in the sediment of Lake Kojima, Okayama Prefecture, Japan, surface sediments (10 samples) were collected and analyzed for Fe, Mn, Cd, Pb, Cu, Zn, Co, Ni, As and P. Partitioning of these metals and P into mineral and organic fractions was determined with selective chemical leaching techniques for sediment samples. Iron, Ni, and to a lesser degree, Co and As were contained in larger amounts in the silicate fraction, than in the non-silicate fractions. Arsenic, Co and Ni were concentrated mainly in the hydrous Fe/Mn oxide, sulfide and organic phases, and Fe was concentrated in the hydrous oxide and sulfide phases. The contents of Mn, Cd, Pb, Cu, Zn and P were lower in the silicate fractions than the non-silicate fractions, especially that of Cd. Manganese was fairly well distributed in all fractions, being dominant in the exchangeable, hydrous oxide and carbonate fractions. A large proportion of Cd, Pb, Cu, Zn and P was concentrated in the exchangeable (especially Cd), hydrous oxide, sulfide and organic fractions. Particularly, the contents of these elements in these four fractions were higher in sediments from the mouths of the Rivers Kurashiki and Sasagase which flow into the lake than in sediments from the lake. The contents of Mn, Cd, Pb, Cu, Zn and P in the silicate fractions were nearly the same in both fine-textured and coarse-textured sediments. Heavy metals and P in the fine-textured sediments were more highly concentrated in the hydrous oxide, sulfide and organic fractions than the coarse sediments. As a result, the total contents of these elements were higher in fine-textured than in coarse-textured sediment. These results indicate that heavy metals and P released by human activity are carried by the rivers into Lake Kojima, are adsorbed on hydrous Fe/Mn oxides and/or clay, are associated with organic matter or absorbed by living things, and are then precipitated and fixed in the sediment. (Author's abstract)
W86-01362

ASSESSMENT OF POLLUTION HISTORY FROM RECENT SEDIMENTS IN LAKE VANAJAVESI, SOUTHERN FINLAND. I. SELECTION OF REPRESENTATIVE PROFILES, THEIR DATING AND CHEMOSTRATIGRAPHY,
Helsinki Univ. (Finland). Dept. of Zoology.
P. H. Kansanen, and T. Jaakkola.
Annales Zoologici Fennici, Vol. 22, No. 1, p 13-55, 1985. 29 Fig, 8 Tab, 135 Ref.

Descriptors: *Lake sediments, *Water pollution, *Lake Vanajavesi, *Finland, Radioactive dating, Wood wastes, Heavy metals, Industrial wastes, Copper, Zinc, Cesium radioisotopes, Plutonium, Cadmium.

Surficial sediments were sampled from eutrophic Lake Vanajavesi (Finland) using 79 short sediment cores. The lake has been subjected to waste water loading for 100 years mainly from the wood processing industry. Of the analyzed heavy metals, zinc, cadmium and copper showed clear enrichment in the selected profiles. For these elements the maximum cultural enrichment factors were 84.6, 6.1, and 2.9, respectively. Zinc was the best tracer for mapping the areal distribution and for giving historical records of industrial waste waters due to the high point source loading from the chemical industry that has occurred since 1943. Dehydroabietic acid content in sediment indicated an abrupt increase since the 1940s in the loading from the wood processing industry. Due to mixing, the peak of Cs-137 and Pu-239,240 was deeper than expected on the basis of mean sedimentation rate. The time scale derived from Cs-137 and Pu-239,240 distribution was in accordance with the zinc stratigraphy and known history of zinc loading. (Baker-IVI)
W86-01365

ASSESSMENT OF POLLUTION HISTORY FROM RECENT SEDIMENTS IN LAKE VANAJAVESI, SOUTHERN FINLAND. II. CHANGES IN THE CHIRONOMIDAE, CHAOBORIDAE AND CERATOPOGONIDAE (DIPTERA) FAUNA,
Helsinki Univ. (Finland). Dept. of Zoology.
P. H. Kansanen.
Annales Zoologici Fennici, Vol. 22, No. 1, p 57-90, 1985. 12 Fig, 11 Tab, 75 Ref.

Descriptors: *Lake Vanagavesi, *Finland, *Eutrophication, *Aquatic insects, Lake sediments, Population dynamics, Midges, Water pollution effects, Eutrophic lakes.

The present midge fauna of Lake Vanajavesi (Finland) was compared to subfossil remains from sediment profiles as part of a study of the development of Lake Vanajavesi during the industrial period of its history in the 19th and 20th Centuries. In Lake Vanajavesi eutrophication has led to the replacement of an oligotrophic Microspectra - Monodiamesa community by a eutrophic Chironomus anthracinus community in the first decades of this century. The replacement took place at a relatively low leading level; about 1/10-1/15 of the present total wastewater load. This is in accord with the established fact that Vanajavesi, like many other lakes in the clay area of southern Finland, was originally eutrophic. The dysoligotrophic features are due to a high humus load. Artificial lowering of the water levels also probably adversely affected the food availability for the midge fauna. A relatively slight cultural impact was needed to cause a return of the eutrophic conditions. In the further succession from a Chironomus anthracinus community to a Chironomus plumosus community, and finally to the disappearance of the deep water fauna, the key factor appears to have been the oxygen content of the water. The oxygen state of Lake Vanajavesi depends not only on the production level of the lake, but more on the direct impact of waste water loading having a high BOD. (Baker-IVI)
W86-01366

CHANCE-CONSTRAINED/STOCHASTIC LINEAR PROGRAMMING MODEL FOR ACID RAIN ABATEMENT - I. COMPLETE COLINEARITY AND NONCOLINEARITY,

Waterloo Univ. (Ontario). Dept. of Civil Engineering.
J. H. Ellis, E. A. McBean, and G. J. Farquhar.
Atmospheric Environment, Vol. 19, No. 6, p 925-927, 1985. 8 Fig, 5 Tab, 22 Ref.

Descriptors: *Acid rain, *Statistical analysis, *Computer programs, *Linear programming, *Model studies, Sulfur dioxide, Fate of pollutants, Path of pollutants, Water pollution prevention.

A Linear Programming model is presented for development of acid rain abatement strategies in eastern North America. For a system comprising of 235 large controllable point sources and 83 uncontrolled area sources, it determines the least-cost method of reducing SO2 emissions to satisfy maximum wet sulfur deposition limits at 20 sensitive receptor locations. The purely deterministic model is extended to a probabilistic form by incorporating the effects of meteorologic variability on the long-range pollutant transplant processes. These processes are represented by source-receptor-specific transfer coefficients. Experiments for quantifying the spatial variability of transfer coefficients showed their distributions to be approximately lognormal with logarithmic standard deviations consistently about unity. Three methods of incorporating second-moment random variable uncertainty into the deterministic LP framework are described: Two-Stage Programming Under Uncertainty (LPUU), Chance-Constrained Programming (CCP) and Stochastic Linear Programming (SLP). A composite CCP-SLP model is developed which embodies the two-dimensional characteristics of transfer coefficient uncertainty. Two probabilistic formulations are described involving complete colinearity and complete noncolinearity for the transfer coefficient covariance-correlation structure. Complete colinearity assumes complete dependence between transfer coefficients. Complete noncolinearity assumes complete independence. The completely colinear and noncolinear formulations are considered extreme bounds in a meteorologic sense and yield abatement strategies of largely didactic value. Such strategies can be characterized as having excessive costs and undesirable deposition results in the completely colinear case and absence of a clearly defined system risk level (other than expected-value) in the noncolinear formulation. (Author's abstract)
W86-01381

AEROSOL CHEMISTRY IN MINNESOTA AND WISCONSIN AND ITS RELATION TO RAINFALL CHEMISTRY,
Minnesota Univ., St. Paul. Dept. of Plant Pathology.
For primary bibliographic entry see Field 2K.
W86-01382

CHEMICAL ZONATION IN GROUNDWATER OF THE CENTRAL PLAINS, CANTERBURY,
North Canterbury Catchment Board, Christchurch (New Zealand).
R. J. Burden.
Journal of Hydrology (New Zealand), Vol. 23, No. 2, p 100-119, 1984. 6 Fig, 3 Tab, 23 Ref.

Descriptors: *Central Plains, *Groundwater, *New Zealand, *Nitrates, Zones, Land use, Chlorides, Water pollution sources, Groundwater pollution, Leaching, Fertilizers, Pastures, Wastewater pollution.

The relationship between land use and nitrate levels in Central Plains (New Zealand) groundwater was studied. The principal sources of nitrate are quantified and the movement and accumulation of nitrate in groundwater are described. Groundwater samples were obtained from about 600 wells over the period 1977 to 1983. Major ion analyses were conducted on water from about 300 wells in the specific study area, mostly located near Christchurch City or near suspected point sources of contamination. The remainder were analyzed for both nitrate and chloride or nitrate alone. The Central Canterbury Plains consist of a vertical sequence of coalesced glacial outwash and postglacial alluvial fans deposited by the Rakaia, Selwyn and Waimakariri Rivers. Several sources contribute to nitrate concentrations in Central Plains groundwater. Dryland pasture is the principal source of nitrate affecting the quality of the groundwater. Cropping is widespread on the deeper soils on the Plains with the amount of nitrate leached from cropland being dependent on soil depth and the timing of irrigation and fertilizer applications. Domestic and industrial sewage from most of the Christchurch metropolitan area and from Lincoln township is disposed, via treatment plants, to surface water and therefore does not affect groundwater quality. The major point sources of waste and irrigated animal effluent together contribute only about 5% of the total nitrate load in Central Plains groundwater. The groundwater has been divided into three chemical zones. Zone 1 lies in regions of recharge from rivers; 2 includes unconfined and semi-confined groundwater down to 60 m below the water table, and some shallow confined groundwater, and 3 comprises all deep circulating groundwater. (Baker-IVI)
W86-01387

PREDICTION OF CHARACTERISTICS FOR VERTICAL ROUND BUOYANT JETS IN STABLY LINEAR STRATIFIED ENVIRONMENT,
Wuhan Inst. of Hydraulic and Electric Power Engineering (China).
For primary bibliographic entry see Field 8B.
W86-01392

COPPER DISSOCIATION FROM ESTUARINE HUMIC MATERIALS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. L. Olson, and M. S. Shuman.
Geochimica et Cosmochimica Acta, Vol. 49, No. 6, p 1371-1375, 1985. 5 Fig, 2 Tab, 37 Ref. NSF grant OCE-7914592.

Descriptors: *Kinetics, *Copper, *Humic acids, *Estuarine environment, Metals, Chemical reactions, Organic matter, Chemical kinetics.

The kinetics of Cu-organic binding in an estuary is examined. Previous data analysis methods have been extended by developing a nonlinear kinetic model for the simultaneous, first order dissociation reactions of CuHM (Cu humic material). The model gives a kinetic spectrum which is used to examine how CuHM rate constants are distributed among bound Cu(II) and how they vary with molecular size and sampling site along a southeastern U.S. estuary. A significant portion of bound Cu(II), 28-54%, reacted with $k > 40$/sec. In general, variations were observed only between size fractions. Since a major portion of Cu(II) bound to HM is labile, it cannot be generally assumed that dissociation is so slow that complexes can be separated from free metal without disturbing the Cu(II)-HM equilibrium. The kinetic spectrum model, described as a set of independently and simultaneously reacting Cu(II) binding sites, can easily accommodate an unknown number of components and a wide range of constants. These features are critical for valid application to a metal-HM kinetic system and interpretation of data. The model also provides a means of optimizing the time range of kinetic measurements by inspection of preliminary data. (Baker-IVI)
W86-01395

PARTITIONING AND TRANSPORT OF METALS ACROSS THE O2/H2S INTERFACE IN A PERMANENTLY ANOXIC BASIN: FRAMVAREN FJORD, NORWAY,
Washington Univ., Seattle. School of Oceanography.
L. Jacobs, S. Emerson, and J. Skei.
Geochimica et Cosmochimica Acta, Vol. 49, No. 6, p 1433-1444, June, 1985. 7 Fig, 6 Tab, 23 Ref. NSF grant OCE 82-13927-1.

Descriptors: *Metals, *Transport, *Framvaren Fjord, *Norway, Anoxic conditions, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium, Solubility, Sulfides, Marine waters.

The zonation of geochemical processes ope in anoxic basins provides a unique opportun weigh their relative importance in the solid ous phase partitioning and transport of across the O2/H2S interface. Water sampl suspended particulates were collected from varen Fjord, Norway. The metals Mn, Fe, Cu, Zn, and Cd showed systematic variati their response to the processes of metal precipitation and metal oxide O2/H2S in cycling. For manganese sulfide a nearly co ion activity product (IAP) is maintained th out the water column. The calculated man sulfide IAP is undersaturated with respe known pure phases, however, the existen manganese as a trace component in fram pyrite (1%) may explain this undersatura solid solution equilibrium is assumed. Tra metals show involvement in both metal formation and metal oxide interface cyclin intensity of this cycling is quantified with model, with the resulting hier Mn>Co>Fe>Ni. The Class B metals sh involvement in interface cycling and stro volvement in metal sulfide precipitation abrupt concentration drop across the O interface observed for copper, zinc and ca translates to a residence time of one year fo metals in the oxic surface water. Surface c trations and the common transport mechani scribed for copper, zinc and cadmium are d coupled to the sediment enrichments (rela the lithogenic component) observed for metals, suggesting that anoxic basins act as lent Class B metal traps. The source of th ment excess could be explained by atmos fallout for cadmium and zinc. (Baker-IVI)
W86-01396

ORGANOCHLORINE CHEMICAL RESI IN WHITE PELICANS AND WES GREBES FROM THE KLAMATH B CALIFORNIA,
California Univ., Davis. Dept. of Wildlif Fisheries Biology.
For primary bibliographic entry see Field 5C
W86-01409

SODIUM IN DRINKING WATER IN SO CAROLINA,
South Carolina State Dept. of Health and En mental Control, Columbia. Div. of Chroni ease.
For primary bibliographic entry see Field 5C
W86-01411

FACTORS CONTROLLING PHOSPH LIMITATION IN STREAM SEDIMENTS,
State Univ. of New York Coll. at Cortland. of Biological Sciences.
For primary bibliographic entry see Field 2H
W86-01417

COMPARISON OF TWO MODELS FOR DICTING RIVER WATER QUALITY,
Birmingham Univ. (England). Dept. of Civil neering.
C. F. Foster, R. W. Crabtree, C. P. Crockett, I. D. Cluckie.
Effluent and Water Treatment Journal, V No. 5, p 161-164, May, 1985. 3 Fig, 2 Tab,

Descriptors: *Model studies, *River flow, quality control, Qual-II, Blackwater River land, Water management, Flow, Dis oxygen, Ammonia, Nitrogen.

The two models which are examined inc general purpose model (Qual-II) and one w river-specific. Each model was applied River Blackwater in order to make the co son. The river specific model was develo predict the possible effects of population and treatment changes in the Blackwater catc (England). It is one dimensional and operat steady-state mode, although dissolved changes due to photosynthesis are modelled steady state, due to diurnal variation in light

model requires an input of calculated relationships for each reach as well as ve plant density for each reach. The based on field work derived constants. requirements for Qual-II are 28 con- 16 parameter values for system identifi- either model gave a perfect prediction. s for Qual-II showed that the best mod- bles were BOD and ammoniacal nitro- ved by DO and nitrate-nitrogen. The the Blackwater model was ammoniacal nd BOD followed by DO and nitrate he fact that Qual-II gave better results DO and nitrate-nitrogen but was slightly ammoniacal-nitrogen, may be due to ng interactions with algal growth rather somonas bacteria. Although the major n applying either model to this river the availability of sufficient hydraulic ularly travel times, the regular use of the United Kingdom could be of real resource management on a catchment r-IVI)

IETAL OCCURRENCE AND GEO- L FRACTIONATION: THE RELA- S OF CATCHMENT SOILS TO AS- ESTUARINE SEDIMENTS,
/niv., Bailrigg (England). Dept. of En- Sciences.
, and S. R. Aston.
tal Pollution (Series B), Vol. 10, p 61- ig, 8 Tab, 19 Ref.

*Heavy metals, *Path of pollutants, stuarine sediments, Goechemistry, ron, Manganese, Cadmium, Copper, Catchment area, England, Particle

veral pathways by which metals from nt soils can eventually be removed for rix and deposited into the receiving tem; data from this study indicate the f a natural leaching process. Catch- d surface sediments from the associat- n Northwest England were analyzed Mn, Cd, Cu, Pb and Zn and the f these metals between geochemical ree types of heavy metal analysis were tal concentrations, the concentrations sidual fraction and the concentration ngeable fraction. In general, metal he catchment soils and estuarine sur- ts are different, with soils showing ng tendency than sediments. For the rable variations in total metal and concentrations were found at different ile the same metal fractions in the ere uniformly distributed. The ob- ions are not dependent on simple ributions. The strong Cd/Mn associa- of leachability indicates a potential release of Cd to the overlying e-IVI)

LL' CONCEPT APPLIED TO OF NON-REACTIVE AND REAC- IPONENTS IN SOILS AND TER,
Univ., Wageningen (Netherlands). and Water Use.
men.
drology, Vol. 78, No. 3/4, p 201-213, ig, 2 Tab, 12 Ref.

*Path of pollutants, *Soil water, ort, Groundwater pollution, Mathe- ns, Tracer studies, Convection, Dif-

sional stationary transport of a com- ribed and the relation between time and flow velocity is derived. The ncept is applied to a two-dimensional em and the results are compared to ental work. It is concluded on the parison between the analytical solu- nvection/diffusion-equation in one dimension and a solution provided by the mixing-cell concept that the latter applied to a two-dimensional groundwater quality problem gives a fair description of the experimentally obtained breakthrough curves and opens perspectives concerning the description of transport of reactive solutes in groundwater. Its simplicity, as compared to other methods, is attractive. (Baker-IVI)
W86-01469

ESTIMATING INTERFACE ADVANCE DUE TO ABRUPT CHANGES IN REPLENISHMENT IN UNCONFINED COASTAL AQUIFERS,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-01474

LONGITUDINAL DISPERSION IN A FOREST STREAM,
Universite Catholique de Louvain, Louvain-la-Neuve (Belgium). Dept. des Sciences du Sol.
C. Legrand-Marcq, and H. Laudelout.
Journal of Hydrology, Vol. 78, No. 3/4, p 317-324, June, 1985. 2 Fig, 14 Ref.

Descriptors: *Streams, *Dispersion, *Path of pollutants, Solute transport, Stream pollution, Differential equations, Stagnant water, Streamflow.

A forest stream typical of those found in SE Belgium and NE France has been studied with respect to the parameters determining the dispersion of a non-reactive solute in a streamflow with stagnant zones. Non-linear adjustment of an analytical solution of two partial differential equations describing longitudinal dispersion and solute exchange between main stream and stagnant water provided a set of parameters describing satisfactorily the experimental results. The dead-zone fraction diminished very rapidly as soon as the flow rate increased beyond a fairly low value and remained constant thereafter. The longitudinal dispersion coefficient followed an inverse pattern but in a somewhat less regular way. Attempts were made to correlate these changes with the Darcy-Weisbach friction factor. (Author's abstract)
W86-01476

DEGRADATION AND MINERALIZATION OF THE POLYCYCLIC AROMATIC HYDROCARBONS ANTHRACENE AND NAPHTHALENE IN INTERTIDAL MARINE SEDIMENTS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. E. Bauer, and D. G. Capone.
Applied and Environmental Microbiology, Vol. 50, No. 1, p 81-90, July, 1985. 6 Fig, 6 Tab, 30 Ref. EPA grant R809475011, NOAA grant NA-80-RAD00057, Hudson River Foundation grant 14/83B/12.

Descriptors: *Polycyclic aromatic hydrocarbons, *Anthracene, *Naphthalene, *Degradation, *Mineralization, *Marine sediments, Intertidal zone, Biodegradation, Acclimatization, Fate of pollutants, Aromatic compounds, Hydrocarbons, Microorganisms, Dissolved oxygen, Temperature effects.

The degradation of the polynuclear aromatic hydrocarbons (PAHs) anthracene and naphthalene by the microbiota of intertidal sediments as investigated in laboratory studies. No mineralization of either PAH was observed in the absence of oxygen. Both rates and total amounts of PAH mineralization were strongly controlled by oxygen content and temperature of the incubations. Inorganic nitrogen and glucose amendments had minimal effects on PAH mineralization. The rates and total amounts of PAH mineralized were directly related to compound concentration, pre-exposure time, and concentration. Maximum mineralization was observed at the higher concentrations (5 to 100 micro-g/g) of both PAHs. Optimal acclimation to anthracene and naphthalene (through pre-exposures to the compounds) occurred at the highest acclimation concentration (1,000 ppm). However, acclimation to a single concentration (100 ppm) resulted in initial relative mineralization rates over a range of re-exposure concentrations (1 to 1,000 ppm) being nearly identical. Maximum mineralization of both PAHs occurred after intermediate periods (1 to 2 weeks) of pre-exposure. The fraction of the total heterotrophic population capable of utilizing anthracene or naphthalene as sole carbon source was also greatest after 2 weeks. (Author's abstract)
W86-01481

RESPONSE OF THE MICROFLORA IN OUTDOOR EXPERIMENTAL STREAMS TO PENTACHLOROPHENOL: COMPARTMENTAL CONTRIBUTIONS,
Connecticut Agricultural Experiment Station, New Haven.
J. J. Pignatello, L. K. Johnson, M. M. Martinson, R. E. Carlson, and R. L. Crawford.
Applied and Environmental Microbiology, Vol. 50, No. 1, p 127-132, July, 1985. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Pentachlorophenol, *Microbial degradation, *Fate of pollutants, Stream pollution, Dissolved oxygen, Chlorinated phenols, Substrates.

Outdoor artificial streams were treated continuously with pentachlorophenol (PCP) for 88 days during the summer of 1983. The contributions of different stream compartments (microbial habitats) to microbial degradation of PCP were determined in a stream treated with 144 micro-g of PCP per liter. The 488-m long stream was composed of mud-bottomed pools alternating with gravel riffles. PCP loss in the stream attributable to microbial degradation after an adaptation period was in the range of 55 to 74%. Contributions to PCP loss were determined for rock surface (epilithic), macrophyte surface (epiphytic), sedimentary, and water column communities by measuring rates of PCP disappearance in stream water, containing ambient concentrations of PCP, in contact with representative compartmental samples. The specific capability, in units of micrograms of PCP per hour per square meter of stream cross-sectional area (macrophytes at maximum plant density, water column at mean depth, upper 10-cm layer of gravel), followed the order rock surface > macrophytes > sediment approximately = water column. The compartmental contribution to total stream losses in units of grams per hour followed the same order, although the differences were smaller. The rate of PCP disappearance in the water column above sediment cores followed the order oxygen-rich > oxygen-poor approximately = anaerobic > sorption-only conditions. The large difference in specific capability between the rock surface and sediment compartments could be attributed to oxygen deficiency (because of chemical and biological oxygen demand) in the sediments. Free-floating and particle-attached organisms in the water column were important to PCP biodegradation. (Author's abstract)
W86-01483

ACID RAIN: DOUSING COMMUNITY RESOURCES,
For primary bibliographic entry see Field 5G.
W86-01488

WATER QUALITY IN AN ESTUARINE ENVIRONMENT: ANNUAL CYCLE OF THE PHYSICAL AND CHEMICAL PARAMETERS OF THE WATER OF THE LOIRE ESTUARY (QUALITE DES EAUX EN MILIEU ESTUARIEN: SUIVI ANNUEL DE CRITERES PHYSIQUES ET CHIMIQUES DANS LES EAUX DE L'ESTUAIRE DE LA LOIRE),
Nantes Univ. (France). Lab. de Biologie Marine.
For primary bibliographic entry see Field 2L.
W86-01505

ESTIMATES OF AVERAGE MAJOR ION CONCENTRATIONS IN BULK PRECIPITATION AT TWO HIGH-ALTITUDE SITES NEAR THE CONTINENTAL DIVIDE IN SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO.

M. M. Reddy, and H. C. Claassen.
Atmospheric Environment, Vol. 19, No. 7, p 1199-1203, 1985. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Precipitation chemistry, *Altitude, *Colorado, Calcium, Sulfates, Nitrates, Seasonal variation, Atmospheric deposition.

The composition of bulk precipitation from two high-altitude sites, established in 1971 near the Continental Divide in southwestern Colorado, has been monitored by season during the past decade. Calcium ions are the predominant cationic species; sulfate is the major anionic constituent. Bulk precipitation major ion concentrations exhibit log-normal distributions. Representative mean and standard deviation values for the major inorganic ionic species present in bulk precipitation have been calculated for three years of consecutive seasons. Standard deviations for all species, except nitrate, are similar. For two years of data grouped into quarters, deviations from mean values fall well within the plus or minus two standard deviation limit. There does not seem to be a systematic deviation from the mean concentration values, with respect to either ionic component or season. (Author's abstract)
W86-01515

LEVELS OF HEAVY METALS IN THE TIDAL ELBE AND ITS ESTUARY AND THE HEAVY METAL INPUT INTO THE SEA,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
L. Mart, H. W. Nurnberg, and H. Rutzel.
Science of the Total Environment, Vol. 44, No. 1, p 35-49, July, 1985. 10 Fig, 2 Tab, 25 Ref. Federal Minister of Research and Technology (Bonn) contract MT 405 g/Aut 03, EEC contracts 173/77 ENVD ENVD690-D.

Descriptors: *Heavy metals, *Elbe River, *Estuaries, *Germany (Federal Republic), Water pollution, Copper, Cadmium, Lead, Nickel, Cobalt, Resuspension, Turbidity, Fate of pollutants.

Surface water samples were collected during missions in 1977, 1978, 1980 and 1983 at different sampling stations along the tidal Elbe, from river km 632 downstream from Hamburg to the outer end of the estuary. Special care was taken to minimize contamination during sampling, handling and analysis. Within the tidal Elbe five distinct zones of substantial anthropogenic heavy metal pollution inputs can be detected. An attempt is made to define anthropogenic background levels, which are extremely low for the dissolved trace metals Cd and Pb; 35 and 65 ng/kg, respectively. The level of dissolved Cu is 2200 ng/kg. Total baseline levels of Cd, Pb and Cu are, respectively, 120, 2500 and 4200 ng/kg. In the five river zones affected by anthropogenic trace metal inputs, distinctly larger maximum levels can occur. They decrease to the background values after mixing with the main water body. More elevated levels caused by re-suspension in the mixing zone with maximum turbidity can be assumed. Nickel and Co data are from one mission only. The order of magnitude of the trace metal input from the Elbe into the sea is evaluated. (Author's abstract)
W86-01516

FATE OF THE PYRETHROID INSECTICIDE DELTAMETHRIN IN SMALL PONDS: A MASS BALANCE STUDY,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. C. G. Muir, G. P. Rawn, and N. P. Grift.
Journal of Agriculture and Food Chemistry, Vol. 33, No. 4, p 603-609, July/August, 1985. 6 Fig, 5 Tab, 27 Ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Insecticides, *Deltamethrin, *Ponds, Fish, Plants, Aquatic plants, Degradation products, Sediments, Water analysis, Pyrethrins.

A quantitative determination was made of the relative importance of various pathways of pollutants such as volatilization, degradation in water and sediment, and uptake by fish and plants, following application of C-14 labeled deltamethrin to water under field conditions. A single application of the insecticide was made at 10 g/ha to two small outdoor ponds, 17 sq m in surface area. Initial concentrations of the insecticide in filtered water ranged from 1.28 to 2.50 microg/L. Deltamethrin rapidly partitioned into suspended solids, plants, sediment, and air, with a half life of 2-4 hr in water. Duckweed and a submerged pondweed accumulated deltamethrin concentrations ranging from 253 to 1021 ng/g, respectively, at 24 hr posttreatment. Sediments were the major sink for radioactivity at 306 days posttreatment, and intact deltamethrin was present at concentrations ranging from 3 to 5 ng/g. Deltamethrin levels in air above the water ranged from 10-100 ng/cu m during a 48 hr monitoring period following application. Fathead minnows accumulated levels of extractable radioactivity 248-907-fold higher than concentrations in water at 24 hr posttreatment, but no fish mortality was observed. (Baker-IVI)
W86-01526

SURVEY OF 2,3,7,8-TETRACHLOROBIDENZO-P-DIOXIN IN FISH FROM THE GREAT LAKES AND SELECTED MICHIGAN RIVERS,
Food and Drug Administration, Detroit, MI. Pesticide and Industrial Chemical Research Center.
N. V. Fehringer, S. M. Walters, R. J. Kozara, and L. F. Schneider.
Journal of Agricultural and Food Chemistry, Vol. 33, No. 4, p 626-630, 1985. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Great Lakes, *Michigan, *Rivers, *Pesticide residues, *Tetrachlorodibenzo-p-dioxin, Saginaw Bay, Lake Huron, Tittabawassee River, Lake Ontario, Dioxin.

Residues of 2,3,7,8-tatrachlorodibenzo-p-dioxin (TCDD) were measured in fish taken from the Great Lakes. Fish from the Saginaw Bay (Lake Huron), the Tittabawassee River in Michigan, and Lake Ontario contained the highest levels of contamination. No TCDD residues at or above the minimum confirmable level of 10 ppt were found in fish from Michigan rivers other than the Tittabawassee. Comparison of the current findings with the results of an earlier study, 1983, suggests a decrease in residue levels with time. Detectable levels of TCDD were found only in carp, catfish, salmon, white perch and trout. No residues at or above the 10 ppt level were found in sucker, whitefish, yellow perch, walleye, bullhead, crappie, bowfin, rockbass, buffalo, white bass, and sheepshead. (Baker-IVI)
W86-01527

EXCHANGE OF WATER IN FJORDS: THE EFFLUX/REFLUX THEORY OF ADVECTIVE REACHES SEPARATED BY MIXING ZONES,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2L.
W86-01536

SOME CONSIDERATIONS IN MODELING THE FATE AND TRANSPORT OF TOXICANTS IN SURFACE WATER SYSTEMS,
Lawler, Matusky and Skelly Engineers, Pearl River, NY.
J. P. Lawler.
Northeastern Environmental Science, Vol. 3, No. 2, p 90-123, 1984. 3 Fig, 31 Ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Model studies, *Martin Creek Lake, *Texas, Selenium, Chlorine, Polychlorinated biphenyls, Metals, Chlorinated hydrocarbons.

Simple, analytical models provide a basis for conceptualizing the important physical, chemical, and biological mechanisms that control the fate and transport of toxic substances in surface water sytems. Mechanisms influencing fate and transport of pollutants in three case studies are described through the use of this modeling approach. In all three studies, the models were employed to provide initial insights to the issues to be a
The total selenium concentrations in the w
sediments of Martin Creek Lake (Tatun
caused by discharges from a lignite-fir
electric generating station were estimate
potential effects of these concentration
biota of Martin Creek Lake were e
Simple, analytical models were employe
vide insights to the chlorine decay proc
results were then utilized to modify sev
plex numerical solution computer models
dynamic and conservative water quality
to include chlorine decay processes. Simp
of the sorption-desorption process were
to outline a research proposal for investi
these processes as they influence polych
biphenyl (PCB) fate and transport in th
River (New York). Levels of certainty
sion in understanding will depend on t
and extensiveness of the data and the
refinement in the model equations; howe
absence of extensive data or model re
much can be learned conceptually and di
ly by utilizing the approach of the simpl
cal model. (Collier-IVI)
W86-01552

**ENVIRONMENTAL IMPACT ASSE
OF THE PCB PROBLEM: A REVIEW,**
Cornell Univ., Ithaca, NY. Ecosystems
Center.
K. E. Limburg.
Northeastern Environmental Science, V
3/4, p 122-136, 1984. 8 Fig, 4 Tab, 50 Ref

Descriptors: *Environmental impact a
*Environmental effects, *Polychlorinate
yls, *Hudson River, *New York, Chlori
drocarbons, Fate of pollutants, Path of
Model studies, Dredging, Estuarine env

Despite a general agreement to deal
Hudson River (New York) PCB problem
ly as possible following the 1976 PCB S
remedial action planning has spanned
eight years. During this period, monito
observation, and experimental work hav
an extensive data base for temporal tren
The emerging trends change or modify
previously understood about PCB dynam
Hudson ecosystem, and a review is prov
original estimate of PCBs released into t
(150 tons) is now thought to be low by
2.5. PCBs have been declining in the
they solubilize, volatilize, enter the biota,
out. Volatilization may be a more
avenue of escape than previously sus
evidenced by a marked decline in lower-
ed forms. A second major issue concerns
cal transport mechanisms for PCBs, and
native models have been proposed but n
ed. The issue of transport has critical ma
implications, for if one of the propose
nisms is the correct one, then dredgi
Thompson Island pool (River Mile 1
potentially remove the source of most
tamination of the estuary. The impact of
examined in terms of what has been lear
fate, transport, and effects of these substa
thor's abstract)
W86-01553

**HUDSON RIVER PCB RELATIONSH
TWEEN RESIDENT FISH, WATER A
MENT,**
New York State Dept. of Environment
vation, Albany.
For primary bibliographic entry see Field
W86-01554

**POLYCHLORINATED BIPHENYLS
HUDSON RIVER: THE VALUE OF
UAL PACKED-COLUMN PEAK ANAL**
Lamont-Doherty Geological Observat
sades, NY.
For primary bibliographic entry see Field
W86-01556

RANSFORMATIONS IN UPPER SEDIMENTS,
lectric Co., Schenectady, NY. Research opment Center.
n, R. E. Wagner, D. L. Bedard, M. J. nd J. C. Carnahan.
rn Environmental Science, Vol. 3, No. 178. 2 Fig, 6 Tab, 3 Ref.

s: *Polychlorinated biphenyl, *Fate of *Hudson River, *New York, *Sedi- orinated hydrocarbons, Path of pollut- ent transport, Biodegradation, Bacteria, bacteria, Degradation, Congeners.

as chromatography and mass spectrom- een used to characterize the PCB con- bution patterns in: (a) the commercial ischarged into the upper Hudson, (b) ecimens altered by bidegradation by cultures isolated from upper Hudson r by water-extraction, and (c) environ- B specimens recovered from upper or sediments. The top layers of the ere found to contain at least two class- c bacteria capable of oxidatively biode- Bs. The commonest of these, represent- nebacterium sp MBI attack PCB mole- g unsubstituted 2,3 (or 5,6) positions. most commonly encountered aerobic resented by Alcaligenes eutrophus s those PCBs having open 3,4 (or 4,5) he modest changes in PCB congener pattern (from that of Aroclor 1242) most of the surface sediments, and the es exhibited by the fish, appeared gen- similar to those effected by the first of robic bacterial groups. Totally differ- ngener distribution patterns were ex- e lower layers of the sediments. These cated that the PCBs there were being lechlorinated, probably by several dif- ations of anaerobic bacteria, to give guishable distributions of dechlorina- . These products consisted mainly of lichlorobiphenyls, which are readily e. Every significant congeneric con- he Aroclor 1242 discharged into the n was found to be degradable by one he oxidative or reductive agents de- Hudson environment. (Author's ab-

CE OF PCB COMPONENTS IN OF THE LOWER HUDSON,
rty Geological Observatory, Pali-

. J. Simpson, B. L. Beck, and N.

Environmental Science, Vol. 3, No. . 8 Fig, 1 Tab, 7 Ref.

*Polychlorinated biphenyls, *Sedi- n River, *Fate of pollutants, Degra- inated hydrocarbons, Congeners, hy.

recent findings in the upper Hudson o evidence was found of significant alteration in sediments of the lower e lower Hudson, chromatograms of iments that have been buried for up s are very similar to chromatograms ed commercial PCB mixtures, while urface samples of the upper Hudson n have compositions totally unlike l PCB mixture. Both of these obser- rly demonstrated by an examination rd and sediment extract chromato- s of capillary chromatograms pro- nce that significant degradation of ongeners occurs in the sediments of on. (Author's abstract)

OF PCB IN HUDSON RIVER DIMENTS,
ytechnic Inst., Troy, NY. Dept. of ng.

Northeastern Environmental Science, Vol. 3, No. 3/4, p 190-196. 5 Fig, 14 Ref.

Descriptors: *Polychlorinated biphenyls, *Fate of pollutants, *Bed load, *Hudson River, *Sediment transport, Chlorinated hydrocarbons, Path of pollutants, Particle size.

In order to measure the transport of a contaminant on river sediments, the sediment transport relations must be determined. In this project, bedload sediment transport in the upper Hudson River was first determined. The bedload samples were analyzed for PCB concentrations, which enabled the determination of PCB transport via the bedload sediments. This is one of a very few investigations that deal with the transport of a toxic contaminant via bedload sediments. Two different types of bedload samplers were utilized: the Helley-Smith bedload sampler, which is a sampler often used by the U.S. Geological Survey; and a Bogardi type bedload sampler, which was developed for studies in New York State rivers and steams. The two samplers complemented each other, and it was possible to obtain satisfactory bedload samples at all times, even under extreme flood flow conditions. During the study period, a wide range of flows were encountered in the Hudson River, enabling the determination of a very satisfactory bedload sediment-discharge relationship. The PCB transport-discharge relation does not correlate as well as the sediment-discharge relation, but this is as expected. The various size fractions of the bedload samples were analyzed for PCB and percent volatiles. There was no correlation between PCB concentration and grain size. However, there was a tendency for higher PCB concentrations to occur in the larger sizes, the opposite of what one might expect. This is attributed to the organics in the sediments, a conclusion borne out by the observation that PCB concentration correlates well with percent volatiles. (Author's abstract)
W86-01560

TRENDS IN PCB TRANSPORT IN THE UPPER HUDSON RIVER,
Lawler, Matusky and Skelly Engineers, Pearl River, NY.
G. Apicella.
Northeastern Environmental Science, Vol. 3, No. 3/4, p 196-201. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Polychlorinated biphenyls, *Hudson River, *New York, *Fate of pollutants, *Sediments, Chlorinated hydrocarbons, Sediment transport, River flow, Model studies, Water pollution sources.

Because of the high affinity of polychlorinated biphenyls (PCBs) for sediment, PCB movement is controlled essentially by the hydraulic changes that affect sediment transport. The transport of PCBs was analyzed for the Upper Hudson River (New York) based on data collected by the U.S. Geological Survey (USGS) from 1976 to 1983 - the period following the major abatement of PCB discharges. Data for temporal trends in PCB concentration at Waterford, New York, were analyzed while accounting for the year-to-year variability in observed flows. A linear regression of PCB concentration vs flow was made using data that are separated into low- and high-flow ranges, that is, below and above 10,000 cfs. The regressions account for the dependence of PCB concentration on the flow at the time of the sampling and enables a comparison among years of PCB data that are normalized for flow. Decreases in PCB concentration over time are found for both flow ranges, suggesting that the riverbed source releases diminishing amounts of PCB to the overlying water. A multiple regression analysis was conducted with PCB concentration as the dependent variable and flow, time, and suspended sediment concentration as candidate independent variables. Results of this analysis confirm a significant trend toward decreasing PCB concentration with time. In addition to time, river flow is a second factor in determining PCB concentration. Suspended sediment concentration does not improve the regression equation significantly because its effect essentially duplicates that of flow, which is already included. An analytical framework for evaluating PCB transport through the Upper Hudson River was developed based on previously collected data. Evaluation procedures comprise extending the analyses of Waterford data to other sampling stations and integrating river flow, which has a long-term cycle of 20 years, into the computation of PCB transport. The effect of the cycle - which will soon enter a phase of generally increasing flow - on the driving force on PCB transport can be evaluated using these analytical approaches. (Author's abstract)
W86-01561

PCB TRANSPORT IN THE FT. EDWARD AREA,
New York State Dept. of Environmental Conservation, Albany.
T. J. Tofflemire.
Northeastern Environmental Science, Vol. 3, No. 3/4, p 203-208. 9 Fig, 1 Tab, 11 Ref.

Descriptors: *Polychlorinated biphenyls, *Hudson River, *New York, *Fort Edwards, *Sediments, *River beds, Chlorinated hydrocarbons, Organic carbon, Fate of pollutants, Path of pollutants, Water pollution sources.

Removal of the Ft. Edwards dam on the Hudson River (New York) in 1973 exposed coarse trashy sediment containing polychlorinated biphenyls (PCBs) and other contaminants. The fate of PCBs in the Ft. Edward area was analyzed with data on river water transport, air transport and dredging transport. The water transport of PCB's at Roger's Island is decreasing with time, although a small unidentified source of PCB north of Area 1 of the remnant deposits may still be present. From water sampling studies at low flow, it was shown that only 25% of the PCB's passing Rogers Island were coming from the east bank or channel. About 40% of the PCB's were coming from sources north of Area 1, with the remainder coming from the broad river bottom areas which are mostly rock. These upstream sources should be located an sampled by some type of integrating and concentrating systems that integrate PCB from water over several weeks. The remnant deposits appear to be scouring much less than before 1979. PCBs have been volatilizing from the remnant deposit sediments; air PCB values over the remnant areas are decreasing with time. The last sampling was in 1982. Depletion of PCB from the surface layer and the build up of organic carbon in the top soil due to increased vegetation on Areas 4 and 5 probably aids this process. (Collier-IVI)
W86-01562

EFFECTS OF DREDGING OPERATIONS ON NUTRIENT AND SUSPENDED SEDIMENT CONCENTRATIONS,
Army Engineer District, New York.
J. F. Tavolaro, and J. M. Mansky.
Northeastern Environmental Science, Vol. 3, No. 3/4, p 208-216. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Dredging, *Nutrients, *Suspended sediments, *Raritan Bay, *New York Bay, *New Jersey, Source of pollutants, Nitrates, Environmental effects, Ammonia, Phosphates.

In response to concerns about the potential impact of dredging operations to water quality, two monitoring efforts were undertaken. Concentrations of dissolved nutrients were monitored for hopper dredging operations in Raritan Bay, NY/NJ and concentrations of suspended sediment were monitored for clamshell dredging operations in the Upper Bay of New York Harbor. Concentrations of TKN, nitrate and total ammonia did not appear to be affected in the vicinity of the dredging. Total phosphate and orthophosphate appeared to decrease while nitrite appeared to increase, although the overall nitrite concentrations were low. Flumes of higher than ambient concentrations of suspended sediment did not persist more than 24 hours after dredging ceased. Maximum concentration ranged from several hundred milligrams per liter on the bottom to less than 100 mg/l on the surface within 60 meters of the dredge. Surface and bottom concentrations decreased rapidly with distance from the dredge and ranged from 20 to 30

mg/l at a distance between 210 meters and 350 meters. Ambient conditions were established within 480 meters on the surface and 570 meters on the bottom. (Author's abstract)
W86-01563

ORIGIN OF HIGH CADMIUM CONCENTRATIONS IN HUDSON RIVER BLUE CRAB (CALLINECTES SAPIDUS RATHBUN),
New York State Dept. of Environmental Conservation, Albany. Bureau of Environmental Protection.
For primary bibliographic entry see Field 5C.
W86-01565

BACKGROUND LEVELS OF DISSOLVED/DISPERSED PETROLEUM RESIDUES IN THE GULF OF ST. LAWRENCE, 1970-79,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
E. M. Levy.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 544-555, March, 1985. 3 Fig, 8 Tab, 16 Ref.

Descriptors: *Gulf of St. Lawrence, *St. Lawrence Estuary, *Saguenay Fjord, *Water pollution sources, *Path of pollutants, *Hydrocarbons, Model studies, Fate of pollutants, Monitoring, Mixing.

A 10-yr program of monitoring the incidence and distribution of dissolved/dispersed petroleum residues in the Gulf of St. Lawrence confirmed that the major source is the Atlantic water that enters through Cabot Strait and demonstrated that a substantial decline in the background levels occurred during the mid-1970's. A model was developed to interpret the geographical distribution of the petroleum residues. The incidence and distribution of dissolved/dispersed petroleum residues in the waters of the Gulf of St. Lawrence and adjoining areas during the period 1970-79 could be interpreted in terms of general background levels pertaining to 'boxes' of water defined solely on the basis of oceanographic/geographic regimes. Since no relationship could be found between the concentration of these substances and depth or any of the other commonly measured oceanographic parameters and because the apparent differences between the concentration levels in neighboring boxes often were not significant, the background levels in the Gulf region at the time of each cruise could be accounted for by a simple model with four or five compartments. The present level, about 0.4 micro-g/L, is similar to those of other unpolluted areas off the east coast of Canada and in the Arctic where it appears that the input from atmospheric deposition exceeds those from accidental spills, deliberate discharges, and other point sources. Although small spills occur occasionally, their effects are usually local and short-term and have little lasting impact on the regional levels. Inputs of petroleum residues from land-based sources around the Gulf are presently insignificant except at the extreme upper reaches of the St. Lawrence Estuary and the Saguenay Fjord; even there the effect is highly localized because of dilution, sedimentation, and other processes of removal associated with the mixing of fresh and saline waters, and therefore, these sources do not make a significant contribution to the background level in the Gulf region as a whole. (Collier-IVI)
W86-01588

STORMWATER RUNOFF FROM HIGHWAYS,
Rhode Island Univ., Narragansett. Graduate School of Oceanography.
E. J. Hoffman, J. S. Latimer, C. D. Hunt, G. L. Mills, and J. G. Quinn.
Water, Air, and Soil Pollution, Vol. 25, No. 4, p 349-364, August, 1985. 3 Fig, 8 Tab, 29 Ref. NOAA grant NA80RAD00047 and EPA grant 68-04-1002.

Descriptors: *Runoff, *Storm runoff, *Highway effects, *Pawtuxet River, *Rhode Island, Highways, Water pollution sources, Hydrocarbons, Trace metals, Metals, Urban runoff, Water quality management.

During four rain events, stormwater runoff samples from Interstate Highway 95 in Rhode Island were collected and analyzed for petroleum hydrocarbons, 14 polycyclic aromatic hydrocarbons (PAHs) and a variety of trace metals. The concentrations were variable throughout the storm events and some of the components responded similarly and others differently depending on the source and form of the component in the runoff. Loading factors as a function of area and traffic volume were developed from the concentration and flow data. Application of the highway runoff loading factors to the Pawtuxet River adjacent to this interstate highway suggests that highway runoff could be the source of over 50% of the annual pollutant loads of solids, PAHs, Pb, and Zn entering this river. It is recommended that highways as a source of non-point pollution to receiving waterbodies should be included as a part of any river and estuarine water quality management planning exercise. (Author's abstract)
W86-01605

IMPACT OF ALKALINE PARTICULATES ON PH OF RAIN WATER IN INDIA,
Indian Inst. of Tropical Meteorology, Poona.
L. T. Khemani, G. A. Momin, M. S. Naik, P. S. Prakasa Rao, and R. Kumar.
Water, Air, and Soil Pollution, Vol. 25, No. 4, p 365-376, August, 1985. 3 Fig, 9 Tab, 47 Ref.

Descriptors: *Precipitation chemistry, *Particulate matter, *Hydrogen ion concentration, *Alkalies, *India, Water pollution sources, Chemical composition, Acid rain, Calcium, Soil.

Rain water samples were collected over a period of a decade from 1974 in Pune, India, a city which is relatively free from industrial pollution. They were also collected at 4 places during 1974 in the region of Bombay which is highly industrialized. The samples were analyzed for major chemical components and pH. The ionic balance was computed. Samples were collected at Delhi during 1965 and 1966 and were analyzed for pH. The values were compared with those reported for 1978. The total suspended particles (TSP) were measured at Delhi during 1980 and analyzed for water soluble components. The rain water at all the places except near the industrial source was not acidic and was characterized by the presence of excess cations, particularly Ca. The acid rain near the industrial source was associated with excess anions, especially sulfate. The difference between the cations and anions was inversely proportional to the H(+) ion concentration. The pH of rain water at Delhi which was in the alkaline range during 1965 and 1966 remained alkaline after a period of 12 yr when the city developed industrially. The TSP in the region was rich with the basic components, mainly Ca, suggesting that the alkaline property of the soil dust is mainly responsible for neutralizing the acidic effects resulting from the anthropogenic gaseous pollutants. (Author's abstract)
W86-01606

CATALYTIC EFFECT OF VARIOUS METAL IONS ON THE METHYLATION OF MERCURY IN THE PRESENCE OF HUMIC SUBSTANCES,
Swedish Environmental Research Inst., Goeteborg.
Y.-H. Lee, H. Hultberg, and I. Andersson.
Water, Air, and Soil Pollution, Vol. 25, No. 4, p 391-400, August, 1985. 6 Fig, 3 Tab, 30 Ref.

Descriptors: *Methylation, *Mercury, *Path of pollutants, *Humic substances, *Metals, Heavy metals, Fulvic acid, Manganese, Aluminum, Iron, Copper, Catalysis, Hydrogen ion concentration.

Methylation of Hg(2+) (Hg(NO3)2) in the presence of fulvic acid (FA) and various metal ions has been studied. The concentrations of Hg(2+) and FA ranged from 5 to 200 mg/L and 171 to 285 mg/L dissolved organic carbon respectively. The pH range was 3 to 6.5. FA was isolated from an acid brown-water lake by XAD-8 polymeric adsorbent. Methylmercury production in the dark during 2 to 4 days incubation at 30 C increased with increasing concentrations of Hg(2+ FA as well as with additions of metal ion mole/L). The observed catalytic activity ions followed the order Fe(3+) (Fe Cu(2+) approximately = Mn(2+) > The production of methylmercury had a mum around 4 to 4.5 at the condition (Author's abstract)
W86-01607

POLYCHLORINATED BIPHENYLS HUDSON RIVER,
New York State Dept. of Environmenta vation, Albany.
M. P. Brown, M. B. Werner, R. J. Sloan, W. Simpson.
Environmental Science and Technology No. 8, p 656-661, August, 1985. 4 Fig, 41 grant C-36-1167-01.

Descriptors: *Monitoring, *Polychlori phenyls, *Hudson River, Fate of pollut Invertebrates, Rivers, Organic compou ments.

As part of a fish-monitoring program co 1977, resident and migrant fish species collected at sites throughout the upper portions of the Hudson River. PCBs analyzed in aquatic macroinvertebrates from the Hudson since 1977. Between 1981 zooplankton samples were collec sites in the lower Hudson and analyzed Between 1977 and 1981 five monitorin were maintained in the upper and lowe of the river. In 1976 and 1977 an exte gram of sediment sampling and mappin volved collection of more than 100 grab samples was conducted in the upper River. The processes largely responsib decline in surficial sediment concentrati lower Hudson are dilution and burial by cleaner sediments recently derived from watershed. Any relaxation of the 1976 placed on commercial and recreational the Hudson River will depend on the FI tion and on the continued decline of PC trations in fish. The differential process environment of PCB congeners, in addi continued decline in PCB concentratio will impose greater difficulty with the u clor-based analyses to support future en tal management decisions. (Baker-IVI)
W86-01616

CALCIUM CHEMISTRY AND DEP IN IONICALLY ENRICHED ON LAKE, NEW YORK,
Upstate Freshwater Inst., Inc., Syracuse,
S. W. Effler, and C. T. Driscoll.
Environmental Science and Technology No. 8, p 716-720, August, 1985. 4 Fig, Ref.

Descriptors: *Calcium, *Fate of pollutan daga Lake, *New York, Particulate m mary productivity, Saturation, Calcium Phosphorus, Epilimnion, Light attenuatio

The chemistry of aqueous calcium and t tion of particulate calcium were studi epilimnion of calcium-polluted Onond NY, over a productive 7-month period. ate calcium transformations, the water c monitored for a number of pertinent wa parameters, and sediment traps were us lect particulate material that settled fro limnion. Thermodynamic calculations in the epilimnion of Onondaga Lake was o ed with respect to the solubility of CaC 80 = 8.48) for the entire period of summ cation. The extent of oversaturation wi to the solubility of CaCO3, and particula deposition, was significantly correlated mary productivity. In-lake formation not only influences calcium transport bu pears to enhance the downward transpo phorus and organic carbon, and cont light attenuation. (Author's abstract)
W86-01618

YLATION OF TIN AND LEAD IN THE ONMENT: OXIDATIVE METHYL FER AS A MODEL FOR ENVIRON-AL REACTIONS,

r Polytechnic (England). School of Chem-

ig, and S. Rapsomanikis.
mental Science and Technology, Vol. 19, 726-730, August, 1985. 4 Tab, 31 Ref.

ors: *Lead compounds, *Tin compounds, ation, *Fate of pollutants, Oxidation, ad, Methyltin, Chemical reactions,

and methyllead compounds (whose y not be gasoline anti-knock compounds) n found in natural waters; these may be from environmental methylation. Reac- in and lead compounds with methyl car- n donors were investigated because these e capable of undergoing oxidative addi- ions to the IV valence state. Tin(II) and ompounds were converted to methyltin yllead derivatives under conditions that natural environment, demonstrating the of environmental methylation for these nd their compounds. Methylating agents er methyl groups by oxidative addition ccur environmentally were used (viz., (CH3)3S(+)I(-), and +)CH2COO(-)). The reactions occurred t temperatures in aqueous media. The general demonstrate that a mechanism that can explain the observed detection n and (non-gasoline derived) methyllead s in the environment. Three natural g agents are capable of environmental n, and these are models for other natu- rring methylating agents. (Moore-IVI)

L COMPOSITION OF FOGWATER ED ALONG THE CALIFORNIA

Inst. of Tech., Pasadena. W.M. Keck vironmental Engineering Science.
J. M. Waldman, J. W. Munger, and M. n.
ital Science and Technology, Vol. 19, 30-736, 1985. 2 Fig, 6 Tab, 40 Ref. Air Resources Board contract A2-048-

*Fog, *Chemical composition, *Acid- rnia, Coastal areas, Fogwater, Acid Chlorides, Nitrates, Air pollution, tion sources, Urban areas.

equent seasonal occurrences along the past, and fogwater may have important ations for acid deposition. Fogwater l at eight coastal sites and one island rotating arm collector. Fogwater col- h urban and nonurban coastal sites was consistently acidic. Millimolar concen- O3(-), and fogwater pH values below erved at sites downwind of the Los n. Fogwater pH dropped down to 1.69 wnwind of the Los Angeles basin gh sulfate pollution episode. The inental, and anthropogenic contribu- gwater composition were determined e apportionment matrix for primary erosol. Fogwater composition at showed evidence of substantial conti- thropogenic contributions. Acid-neu- cities in coastal air were found to be insufficient to neutralize even small hloride loss in fogwater relative to its ibution was observed at sites furthest ogenic sources. (Moore-IVI)

TION OF NEW, FLUORINATED IN THE NIAGARA RIVER-LAKE REA,

, Bloomington. Dept. of Chemistry. R. A. Hites.
l Science and Technology, Vol. 19, 740, August, 1985. 5 Fig, 1 Tab, 33

Ref. EPA grant 808961.

Descriptors: *Water pollution sources, *Fluorinated biphenyls, *Niagara River, *Lake Ontario, *Niagara Falls, *New York, Halogenated hydrocarbons, Fish, Sediments, Hazardous wastes, Waste dumps.

Bloody Run is a small creek that drains the Hyde Park hazardous waste dump in Niagara Falls (New York). Bloody Run Creek flows into the Niagara River, which is the major water source for Lake Ontario. Lake Ontario sediment cores were taken from the major sedimentation basins; sediment grab samples were collected from Bloody Run Creek, and the creek system adjacent to the Love Canal. Fish were sampled for the Niagara River, Lake Ontario, and the Little Niagara River. Sediment and fish samples were analyzed by capillary gas chromatographic mass spectrometry using negative ion methane chemical ionization. A series of bis(trifluoromethyl)-substituted polychlorinated biphenyls was discovered. These compounds were present in fish as well as in sediments, and their major source seems to be the Hyde Park dump in the city of Niagara Falls, NY. The concentrations of all compounds are 4-6 orders of magnitude higher in the Bloody Run Creek sediment than in Lake Ontario. (Moore-IVI)
W86-01621

COMBINED EFFECT OF GEOLOGY, PHOSPHATE SOURCES AND RUNOFF ON PHOSPHATE EXPORT FROM DRAINAGE BASIN,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
D. C. Grobler, and M. J. Silberbauer.
Water Research, Vol. 19, No. 8, p 975-981, 1985. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Phosphates, *Geological formations, *Runoff, *South Africa, Catchment areas, Water pollution sources, Non-point pollution sources, Bioavailability, Particulate matter.

A large degree of uncertainty is usually associated with phosphate loads estimated by means of export coefficients. Methods of reducing this uncertainty were investigated. Soluble and total phosphate export coefficients were calculated for 7 South African catchments over periods covering 3-5 years. Spatial variance in the export coefficients could largely be accounted for if catchments were grouped according to their geological characteristics; those in the upper Limpopo River drainage basin having igneous and those in the Vaal River drainage basin having sedimentary geological formations. A secondary, but nonetheless important factor contributing to the spatial variance of export coefficients was whether or not a particular catchment contained mainly point or mainly non-point sources. After catchments were grouped according to these two factors, 74%-99% of temporal variance of export coefficients could be explained by fitting linear regression equations to phosphate export vs runoff. The possible link between the bio-availability of particulate phosphorus and catchment geology is discussed. The significance of such a link, with regard to phosphate load estimates and making projections of future trophic status, is emphasized. (Author's abstract)
W86-01639

NITRATE BEHAVIOUR IN STREAMFLOW FROM A GRASSLAND CATCHMENT IN DEVON, U.K.,
Exeter Univ. (England). Dept. of Geography.
B. W. Webb, and D. E. Walling.
Water Research, Vol. 19, No. 8, p 1005-1016, 1985. 12 Fig, 3 Tab, 25 Ref.

Descriptors: *Nitrates, *Grasslands, *River Dart, *Devon, *England, Runoff, Seasonal variation, Storm runoff, Magnesium, Pollution load, Streams, Catchment area.

NO3-N levels and loadings in the River Dart, Devon, U.K. have been intensively monitored during the study period February 1975-January 1983, and NO3-N behavior in streamflow is compared with that of Mg which has predominantly contrasting origins and controls in runoff. A strongly developed annual regime characterizes daily mean NO3-N concentrations which peak at 4.5 mg/l in December and reach a minimum of 1.1 mg/l in early autumn, and this regime is reflected in a positive relationship between NO3-N concentration and discharge. Storm-period NO3-N behavior also exhibits a marked seasonal variation, and 'dilution' responses are typical of the winter period whereas a 'concentration' effect is more characteristic of summer months and is attributed to the influence of soil throughflow. Spring and autumn are associated with a transition in storm-period behavior, and the reaction of NO3-N concentrations during individual events or over a sequence of storms at any time of the year may also vary in response to a complex interplay of factors. NO3-N transport is more strongly biased towards storm events than is Mg, and more than 50% of the total NO3-N load was removed in only 10% of the study period. The mean annual NO3-N load for the study basin (24 kg/ha) is higher than that recorded in many grassland catchments of the U.K. but does not reflect an unusually high rate of fertilizer application. Unlike several other arable and grassland drainage basins studied in Britain, there is no evidence in the River Dart of a significant upward trend in NO3-N concentrations and loads since 1975. (Author's abstract)
W86-01642

ROLE OF MN(2+)-RICH HYDROUS MANGANESE OXIDE IN THE ACCUMULATION OF ARSENIC IN LAKE SEDIMENTS,
National Inst. for Environmental Studies, Tsukuba (Japan). Water and Soil Environment Div.
T. Takamatsu, M. Kawashima, and M. Koyama.
Water Research, Vol. 19, No. 8, p 1029-1032, 1985. 4 Fig, 20 Ref.

Descriptors: *Arsenic, *Hydrous manganese oxide, *Lake sediments, Lake Biwa, Japan, Adsorption, Sediments, Manganese, Fate of pollutants.

The adsorption of As onto synthetic HMO and the association of Mn and As in the sediment cores from samples taken from Lake Biwa were examined. Arsenic has accumulated to high concentrations in the thin surface layers. The sedimentation rate suggests that the As-rich layers were deposited within the 4 years prior to sampling but no dramatic increase of As in flow to the lake was noted for that period. On the other hand, the coincident depth profiles of As and Mn concentrations in the cores and As concentrations up to 721 mg/kg in Mn concretions suggest that the surface accumulation of As may result from a dissolution-deposition cycle within the sedimentary column associated with that known to occur for Mn. In the absence of a divalent cation, no appreciable adsorption of arsenate onto HMO occurred between pH 6 and 8, a range often encountered in aquatic environments. There was a substantial increase in the amount of arsenate adsorbed by HMO in the presence of the divalent cations of Mn, Sr, Ba, and Ni. Hydrous Mn oxides, positively charged from the adsorption of Mn(2+) ions, could play a significant role in the accumulation of As on the surface of lake sediments. (Baker-IVI)
W86-01645

DIAGENETIC REMOBILIZATION OF MANGANESE, IRON, COPPER AND LEAD IN ANOXIC SEDIMENT OF A FRESHWATER POND,
Central Research Inst. of Electric Power Industry, Tokyo (Japan).
For primary bibliographic entry see Field 2H.
W86-01646

CHEMICAL CHARACTERIZATION OF STRATUS CLOUDWATER AND ITS ROLE AS A VECTOR FOR POLLUTANT DEPOSITION IN A LOS ANGELES PINE FOREST,
California Inst. of Tech., Pasadena. W.M. Keck Lab. of Environmental Engineering Science.
J. M. Waldman, J. W. Munger, D. J. Jacob, and M. R. Hoffmann.
Tellus, Vol. 37B, No. 2, p 91-108, April, 1985. 8

Fig, 4 Tab, 55 Ref. California Air Resources Board contract A2-048-32.

Descriptors: *Cloudwater, *Acid deposition, *Forests, *Los Angeles, *Acid rain, *California, Hydrogen ion concentration, Pine trees, Nitrates, Sulfates, Rain, Fog precipitation, Calcium, Potassium.

Highly concentrated, acidic stratus cloudwater was monitored as it intercepted a pine forest (Henninger Flats) 25 km northeast of Los Angeles, California. Observed pH values ranged from 2.06 to 3.87 for over 100 samples collected in 1982 and 1983 with a median value below pH 3. The ratio of nitrate/sulfate in cloudwater samples was between 1.5 and 2; rainwater at the same site had a ratio of approximately 1. The solute deposition accompanying several light, spring rains (summing to about 1% of annual rainfall) was a disproportionate fraction of the annual total: H(+), NO3(-) and SO4(2-) were about 20% or more. Based on a reasonable estimate of fog precipitation, deposition of sulfate, nitrate and free acidity due to intercepting stratus clouds may be of comparable magnitude as that due to the incident rainfall at Henninger Flats. Cloudwater that had deposited on local pine needles was collected. It was in general more concentrated than ambient cloudwater but with comparable acidity. Enrichment of K(+) and Ca(2+) in those samples and in through fall is believed to be due to leaching from foliar surfaces. Injury to sensitive plant tissue has been noted in the literature when prolonged exposure to this severe kind of micro-environment has been imposed. (Author's abstract)
W86-01652

MODEL FOR NITRATE LEACHING IN UNDISTURBED STRUCTURED CLAY SOIL DURING UNSTEADY FLOW,
Oxford Univ. (England). Soil Science Lab.
R. E. White.
Journal of Hydrology, Vol. 79, No. 1/2, p 37-51, July, 1985. 4 Fig, 3 Tab, 29 Ref.

Descriptors: *Nitrates, *Leaching, *Unsteady flow, *Clay, Mixing, Model studies, Unsaturated flow, Solute transport, Diffusion, Chlorides, Nitrification, Soil water, Mathematical equations.

A two-domain mixing model is described for predicting nitrate leaching during unsteady unsaturated flow through soil. The model assumes that water infiltrating the soil surface mixes incompletely with resident water to form a miscible transport volume, the size of which can vary with time. Changes in solute storage within the transport volume can occur by diffusion and biological transformations. Output from the transport volume is by drainage from a lower surface in the soil. The model's output was tested against the measured amounts of NO3-N leached from large undisturbed cores of structured clay soil during constant flux irrigation with 10 mM CaCl2. The average concentration of NO3(-) and Cl(-) in the soil solution was determined by extraction of small cores taken around the large cores prior to leaching. The rate of nitrification in the soil was also measured. The change in the transport volume with time was calculated from equations for the mass balance of water and Cl(-) in the transport volume. Knowing the transport volume, analogous equations in terms of NO3(-) were solved to predict the NO3(-) concentration in the effluent. Good agreement between predicted and observed NO3-N leached was obtained for cores showing divergent trends in NO3(-) leaching. A large difference between cores in the fraction of soil NO3-N leached (0.34 compared to 0.13) was attributed to the difference in the volume of high-nitrate soil water that mixed with infiltrating water to form the transport volume, and to differences in the distribution of NO3(-) between ped faces and ped interiors. The merit of incorporating the concept of a variable transport volume into a transfer function model for predicting NO3(-) leaching is briefly discussed. (Author's abstract)
W86-01655

LEACHING FRACTION BEYOND DEPTH X, CAUSED BY PERCOLATION OF A SOIL PROFILE WITH AN INITIAL SALT ACCMULATION AT ITS SURFACE,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 2G.
W86-01662

GEOCHEMICAL MASS BALANCE OF A VOLCANIC CRATER LAKE IN AUSTRALIA,
Flinders Univ. of South Australia, Bedford Park. School of Earth Sciences.
For primary bibliographic entry see Field 2H.
W86-01663

DISPERSAL PATHWAYS FOR PARTICLE-ASSOCIATED POLLUTANTS,
Exxon Production Research Co., Houston, TX.
R. A. Young, D. J. P. Swift, T. L. Clarke, G. R. Harvey, and P. R. Betzer.
Science, Vol. 229, No. 4712, p 431-435, August, 1985. 5 Fig, 27 Ref.

Descriptors: *Dispersion, *Path of pollutants, *Fate of pollutants, *New York Bight, *New York, *Particulates, Water pollution sources, Ocean dumping, Coastal waters, Model studies, Estuarine environment, Sediment transport, Particulate transport.

A prototype study of the effects of dumping of anthropogenic wastes into the ocean has been the New York Bight Program of the National Oceanic and Atmospheric Administration. Particle-associated pollutants (totaling 10 to the 7th power metric tons per year) are introduced into the New York Bight by ocean dumping, estuarine discharge, sewage outfalls, eolian transport, and shipping waste and spillage. Because pollutants are associated with fine sediment particles, their fate in the New York Bight is intimately related to sediment transport processes. Sediment transport in the Bight is not a simple function of fluid transport. A combined flow boundary layer model was developed to improve near-bottom sediment transport predictions, and semiempirical relations were derived to predict resuspension of the small amounts of pollutant-bearing mud dispersed in the sand-dominated substrate. Oceanic and estuarine circulation processes dilute and transport the particles by a natural dispersal system that also tends to be highly distributive; particle-associated pollutants apparently seek the same sinks in the Hudson River shelf valley and intracoastal wetlands, regardless of their point of introduction. These sinks are inferred to be largely within the intracoastal zone of marshes, estuaries, and lagoons, and it is these areas that may determine the pollutant-related assimilative capacity of the New York Bight Apex as a whole. (Collier-IVI)
W86-01677

GROUND WATER QUALITY ANOMALIES ENCOUNTERED DURING WELL CONSTRUCTION, SAMPLING AND ANALYSIS IN THE ENVIRONS OF A HAZARDOUS WASTE MANAGEMENT FACILITY,
Woodward-Clyde Consultants, Walnut Creek, CA. Environmental and Engineering Services.
For primary bibliographic entry see Field 5A.
W86-01700

BIOGEOCHEMISTRY OF LEAD IN MCDONALDS BRANCH WATERSHED, NEW JERSEY PINE BARRENS,
Oak Ridge National Lab., TN.
R. S. Turner, A. H. Johnson, and D. Wang.
Journal of Environmental Quality, Vol. 14, No. 3, p 305-314, 1985. 8 Fig, 7 Tab, 38 Ref. U.S. Dep. of Energy contract DE-ACO5-840R21400.

Descriptors: *Geochemistry, *Biochemistry, *Lead, *McDonalds Branch watershed, *Pine Barrens, *New Jersey, *Heavy metals, Metals, Fate of pollutants, Atmospheric deposition, Water pollution sources, Air pollution, Precipitation, Plant tissues, Forest soils, Soil horizons.

Lead concentrations, fluxes, and storage were measured in the vegetation, forest floor, and acid, sandy mineral soil (Quartzip-samments) of a forested watershed watershed in the New Jers
Barrens. Atmospherically deposited Pb
McDonalds Branch Watershed was 140 g/
micro-g/L in bulk precipitation) in 1980 to
substantial reduction from 350 g/ha/yr (1
g/L in bulk precipitation) in 1978 and 1979
ally all Pb falling on the uplands was re
75% by the organic forest floor and 25% b
al soils, especially in B and C soil horizon
Pb content of the forest floor was 7.6 kg/
an accumulation rate of 100 g/ha/yr (198
or 1.3% of the forest floor pool. Estimat
residence time of Pb in the forest floor wa
About 35 g Pb/ha/yr moved out of the for
in solution through the E horizon and wa
lated strongly with dissolved organic mat
proximately 30 g Pb/ha/yr accumulated
and C soil horizons. Less than 1 g Pb/ha/y
lated past a depth of 2 m. Lowland muck
vegetation accumulated 98% of incoming
only 3.2 g Pb/ha/yr exported in the strea
concentrations in the stream were correla
tively with dissolved organic matter an
level in the swamps. Lead in biota was c
mainly in the bark, fine roots, and foliage.
trations were: Fine roots (18 mg/kg) >
mg/kg) > foliage (4 mg/kg) > wood (0.5
Although Pb concentrations in herbs, mo
lichens ranged from 10 to 60 mg/kg, the
accounted for very little biomass. Total Pb
of biota was 355 g/ha, about 4% of the fo
Pb content. (Author's abstract)
W86-01703

**BIOGEOCHEMISTRY OF ALUMIN
MCDONALDS BRANCH WATERSHE
JERSEY PINE BARRENS,**
Oak Ridge National Lab., TN.
R. S. Turner, A. H. Johnson, and D. Wan
Journal of Environmental Quality, Vol.
p 314-323, 1985. 7 Fig, 5 Tab, 42 Ref.

Descriptors: *Biochemistry, *Geochemist
minum, *McDonalds Branch watershe
Barrens, *New Jersey, *Trace metals,
pollutants, Acid precipitation, Forest so
tissues, Soil horizons, Soil water, Hydr
concentration, Metals, Water pollution eff

Aluminum concentrations, fluxes, and
were measured in the vegetation, forest
acid, sandy mineral soil of a forested wa
the New Jersey Pine Barrens. Volume-
mean Al concentrations in solution inc
water passed through the upland ecosyst
0.012 mg/L in bulk precipitation to 0.14
throughfall to 0.45 mg/L in E horizon mi
0.60 mg/L in the B horizon, and 0.73 mg
C horizon. Weighted mean Al concentrat
stream water was 0.15 mg/L. Solution A
trations in different compartments of the
were related to the magnitude of mois
dissolved organic carbon concentration,
Soil solution and stream water Al conc
were high in the winter and spring and
summer and fall, inversely following so
Soil solution and stream pH were indep
precipitation pH because of internal c
H(+) concentration by the soil and an
0.5-yr time lag in flushing of atmospher
posited acids through the soil. Aluminum
titioned strongly into the lower mineral
zons, but large stores of potentially labil
found in the upper mineral horizons
floor. Standing vegetation represented a
small pool of Al but cycled substantial a
Al between mineral soil and the forest f
thor's abstract)
W86-01704

**LEAD DISTRIBUTION AND FLUX
HIGH-ELEVATION FOREST IN NO
VERMONT,**
Pennsylvania Univ., Philadelphia.
A. J. Friedland, and A. H. Johnson.
Journal of Environmental Quality, Vol.
p 332-336, 1985. 3 Fig, 2 Tab, 35 Ref.

Descriptors: *Lead, *Vermont, *Forest
soils, *Heavy metals, *Fate of pollutant

ests, Atmospheric deposition, Water pollu-
urces, Metals, Leaching, Residence time,
lant tissues, Streams.

evation forests receive large amounts of
eric lead (Pb) and accumulate it in the
oor. In order to determine Pb partitioning
ntane, coniferous forest, forest floor and
soil (Haplorthods and Fragiorthods) and
n parts (leaves, twigs, bark, wood) were
for their Pb content. Soil and stream
ere sampled to estimate Pb flux. Mean Pb
ation in trees, in mg/kg, was root bark
vigs (28.3), bark (23.0) > root wood (10.4)
e (3), wood (3). Total Pb in above-ground
(trees + shrubs + herbs) was 0.89 kg/ha.
the organic horizon (forest floor) was 20
hile Pb in the mineral horizon (E + B)
g/ha. Monitoring of soil water for one
ded volume-weighted mean Pb concentra-
3.7, 1.8, 1.1 and 1.0 micro-g/L at 3-, 12-,
0-cm depth, respectively. Stream Pb con-
averaged 0.6 micro-g/L. Annual Pb
stimated to be > 700 g/ha/yr. Estimated
m the forest in stream water was < 12
Annual accumulation in the forest floor is
ately 3% of the current forest floor Pb
t current accumulation rates, forest floor
t will double in 30 to 40 yr. At current
ates, mean residence time of Pb in the
r is approximately 500 yr. The ratio of
o output for the forest is 60:1. (Author's

6

**IVE DECHLORINATION OF THE
ES 2,4-D, 2,4,5-T, AND PENTACH-
ENOL IN ANAEROBIC SLUDGES,**
State Univ., East Lansing. Department of Crop
iences.
ry bibliographic entry see Field 5D.

**ION OF CARBARYL AND THE 1-
OL METABOLITE IN FLOODED
LDS,**
nd M Univ., College Station. Department of
op Sciences.
l, K. W. Brown, J. D. Price, and F. T.

Environmental Quality, Vol. 14, No. 3,
1985. 6 Fig, 2 Tab, 11 Ref.

: *Carbaryl, *Napthol, *Rice fields,
llutants, Irrigation management, Pesti-
ticides, Rainfall, Crop production.

aboratory experiments were conducted
led rice (Oryza sativa L.) culture to
ersistence of carbaryl (1-napthyl-N-
amate) and the 1-naphthol metabolite.
consisted of two rates of carbaryl (1.12
/ha) super-imposed on two irrigation
t schemes (ie, intermittent and continu-
determine their potential for environ-
amination. Results showed that foliarly
aryl was washed from the rice canopy
ater and subsequently degraded via
d biological mechanisms. Time of
ction and application rate had a highly
fluence on the residual levels of car-
flood water for each of the 3 yr tested.
f irrigation management was statistical-
t in two of the three seasons studied,
levels of carbaryl residues observed
rmittent irrigation scheme. Carbaryl
lot water were greatest in those years
all event occurred within 24 h follow-
r spray application. A significant first
tion between time and application rate
d in 1973 and 1975, when measurable
recorded prior to the 24-h sampling
1-Naphthol recovered in the plot
roportional to the contamination level
ryl spray formulation did not reflect
s of dissipated carbaryl. Field results
y experiments suggested that 1-naph-
raded more rapidly under flooded soil
an carbaryl. (Author's abstract)

NUTRIENT RUNOFF LOSSES AS PREDICTED BY ANNUAL AND MONTHLY SOIL SAMPLING,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
A. N. Sharpley, S. J. Smith, W. A. Berg, and J. R. Williams.
Journal of Environmental Quality, Vol. 14, No. 3, p 354-360, 1985. 4 Fig, 6 Tab, 24 Ref.

Descriptors: *Nutrients, *Runoff, *Soil sampling, *Prediction, Phosphorus, Nitrogen, Grasslands, Nutrient transport.

The transport of soluble and particulate P and N in runoff from several cropped and grassed watersheds in Oklahoma and Texas was related to the nutrient content of surface soil (0-50 mm) sampled monthly and annually (March) over a 2-yr period in an effort to improve the prediction of nutrient transport. For both monthly and annual soil samplings, the prediction of soluble P was good for events > 0.75 mm runoff (r values ranged from 0.57 to 0.92), but smaller events were poorly predicted. The nitrite content of runoff was not closely related to surface soil content (r values ranged from 0.17 to 0.58), precluding its accurate prediction in runoff. Prediction of both particulate P and total N concentrations of individual runoff events was improved using separate equations for grassed and cropped watersheds compared to a general equation. Even so, predicted mean annual flow-weighted concentrations and amounts of soluble P, particulate P, and total N using either monthly or annual soil nutrient data were significantly related to measured values at the 0.01 level and above (r values ranged from 0.57 to 0.97). Results indicate that seasonal variation in soil nutrient content had less effect on the predictive equations than rainfall and management characteristics. Consequently, these characteristics must be accounted for before the transport equations can be reliably used on an individual runoff event basis. (Author's abstract)
W86-01709

DESCRIPTION AND APPLICATION OF AN ANIMAL WASTE PHOSPHORUS LOADING MODEL,
Wisconsin Univ.-Madison.
I. C. Moore, and F. W. Madison.
Journal of Environmental Quality, Vol. 14, No. 3, p 364-369, 1985. 6 Tab, 30 Ref.

Descriptors: *Animal wastes, *Phosphorus loading, *Nutrients, Manure, Model studies, Fate of pollutants, Water pollution sources.

An animal waste loading model was developed to estimate total phosphorus (P) loadings from winter-spread manure, barnyards and feedlots, and aboveground manure storage facilities. Literature studies were used to establish the percentage of manure P which could potentially be carried in runoff from a specific manure source. Likewise, a critical distance over which manure polluted runoff must travel as overland flow in order for P to be reduced to background levels was established. The model was tested on a 328-ha watershed in Shawano County, WI, which is devoted to dairy agriculture and where surface water was monitored and intensive land use inventories were completed. For the years 1974 to 1976, the model predicted total P loadings from animal wastes of 96.0 kg/yr, of which 24.6 kg/yr or 26% was attributed to winter spreading, and the balance of 71.4 kg/yr or 74% to runoff from barnyards and above-ground storage facilities. The animal waste model was linked to a model estimating cropland losses of total P to develop a prediction of total P losses from the watershed. Comparison between predicted and monitored values suggested that the animal waste model was a useful tool for estimating total P losses from various waste handling practices on a long-term basis. As such, it will serve as a valuable planning tool for nonpoint source abatement programs. (Author's abstract)
W86-01710

SORPTION AND TRANSPORT OF HYDROPHOBIC ORGANIC CHEMICALS IN AQUEOUS AND MIXED SOLVENT SYSTEMS: MODEL DEVELOPMENT AND PRELIMINARY EVALUATION,
Florida Univ., Gainesville. Dept. of Physics.
P. S. C. Rao, A. G. Hornsby, D. P. Kilcrease, and P. Nkedi-Kizza.
Journal of Environmental Quality, Vol. 14, No. 3, p 376-383, 1985. 7 Fig, 2 Tab, 29 Ref.

Descriptors: *Pollutant transport, *Sorption, *Organic chemicals, *Model studies, *Fate of pollutants, Solubility, Waste disposal, Solvophobic theory.

A theoretical approach, based upon the assumption of predominance of solvophobic interactions, was formulated to quantitatively describe the sorption and transport of hydrophobic organic chemicals (HOC) from aqueous and aqueous-organic-solvent mixtures. In the theoretical approach, solvent-sorbate interactions (solubility) are specifically considered in order to predict sorbate-sorbent interactions (sorption). For HOC sorption from a single solvent, the HOC sorption coefficient was shown to increase loglinearly with the hydrocarbonaceous surface area (HSA) of the sorbate. For HOC sorption from aqueous-organic binary solvent mixtures, the sorption coefficient is predicted to decrease exponentially as the fraction of organic cosolvent increases. This is a direct consequence of increased HOC solubility in the binary solvent. Because sorption and mobility of HOC are inversely related, a decrease in sorption coefficient leads to an enhanced HOC mobility as the fraction of organic cosolvent is increased. A preliminary verification of the theory was performed by an analysis of published data for (i) HOC sorption by soils and sediments from water, (ii) HOC retention by reversed-phase chromatographic sorbents during isocratic elution with methanol-water binary solvent mixture, and (iii) HOC mobility on soil-TLC plates eluted with ethanol-water mixtures. (Author's abstract)
W86-01711

USING CREAMS AND ECONOMIC MODELING TO EVALUATE CONSERVATION PRACTICES: AN APPLICATION,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
B. M. Crowder, H. B. Pionke, D. J. Epp, and C. E. Young.
Journal of Environmental Quality, Vol. 14, No. 3, p 428-434, 1985. 1 Fig, 2 Tab, 21 Ref. Pennsylvania Agricultural Exp. Stn. project 2587.

Descriptors: *Soil conservation, *Model studies, *Economic aspects, Nutrient loss, Conservation, Erosion, Agricultural runoff, Nonpoint pollution sources, Conservation tillage.

Economic modeling of the impacts of soil loss from agricultural activities traditionally has been based on the Universal Soil Loss Equation (USLE). Most studies have not considered the effects of agricultural production on N, P, and pesticides in runoff. This study, involving a representative Pennsylvania dairy farm, uses the CREAMS model (Chemicals, Runoff, and Erosion from Agricultural Management Systems) to estimate surface runoff losses of soil, plant nutrients, and pesticides. The CREAMS is a continuous simulation model that allows the user to compare the effectiveness of management practices for reducing these losses in a consistent and comprehensive manner. The usefulness of the CREAMS simulation model is demonstrated for analysis of agricultural cropping activities and their impacts on losses of chemicals and soil in runoff. Linear programming was used to simulate the impacts of farm-level water pollution restrictions on farm income. Nonpoint source pollution can be reduced without necessarily reducing farm income. Farm income levels could be maintained by adopting conservation tillage practices or by changing crop rotation. Conservation tillage was found to be the most effective method for maintaining income when water pollution restrictions were imposed. Two years of corn (Zea mays) followed by 3 yr of alfalfa (Medicago sativa) was a profitable and effective rotation for controlling runoff losses. Continuous corn, at the other extreme, caused substan-

tial losses of income when restrictions were imposed. (Author's abstract)
W86-01715

REDISTRIBUTION OF BROMIDE BY RAINFALL INFILTRATION INTO A CECIL SANDY LOAM LANDSCAPE,
Agricultural Research Service, Watkinsville, GA.
R. R. Bruce, R. A. Leonard, A. W. Thomas, and W. A. Jackson.
Journal of Environmental Quality, Vol. 14, No. 3, p 439-445, 1985. 13 Fig, 3 Tab, 12 Ref.

Descriptors: *Bromide, *Rainfall, *Infiltration, *Soil types, Solute transport, Leaching, Erosion, Topography, Permeability coefficient.

The redistribution of bromide applied to the soil surface at selected position in a sample Cecil sandy loam (clayey, kaolinitic, thermic Typic Hapludults) landscape was measured in relation to rainfall and pedon characteristics. Three bromide application sites were located in drainageway positions and three on slope positions exhibiting different degrees of erosion. Observations of nearly 4 yr measured 4.7 m of rainfall to show that rainfall was more effective in transporting Br through drainageway pedons than those on the slopes. After 1000 mm of rainfall, half of the applied Br was above 0.6 m on the slope sites and above 1.0 m on the drainageway sites. This difference seems to relate closely to the higher hydraulic conductivity in the Bt horizon above the 1.2 m in the drainageway pedons than in the slope pedons. Also, the maximum clay zones in the Bt horizons of the drainageway sites were significantly lower than those on the slope sites and occurred about 0.5 m deeper. At the completion of this study, an elevated Br level was measured in a drainageway site between 1.5 and 2.4 m with no evidence of Br below 3.8 m. These data provide a basis for assigning solute transport characteristics to the identified variability in this and similar landscapes. (Author's abstract)
W86-01716

SIMULTANEOUS IN-STREAM NITROGEN AND D.O. BALANCING,
Texas Univ. at Dallas, Richardson. Callier Center for Communication Disorders.
For primary bibliographic entry see Field 2H.
W86-01722

NITROGEN ACCOUNTABILITY FOR FERTILE STREAMS,
Texas Univ. at Dallas, Richardson. Callier Center for Communication Disorders.
For primary bibliographic entry see Field 2H.
W86-01723

OUTFALL DILUTION: THE ROLE OF A FAR-FIELD MODEL,
Miami Univ., Coral Gables, FL. Dept. of Civil and Architectural Engineering.
D. A. Chin.
Journal of Environmental Engineering, Vol. 111, No. 4, p 473-486, August, 1985. 10 Fig, 6 Ref.

Descriptors: *Outfall, *Far-field models, *Model studies, *Dilution, Wastewater outfall, Near-field mixing, Far-field mixing, Fate of pollutants, Path of pollutants, Coastal waters.

Effluent dilutions predicted by near-field models do not realistically reflect near-field conditions in tidally influenced coastal waters since they neglect the advection of the pollutant cloud over the source. A theoretical solution has been developed for the case in which a conservative pollutant is released from a line source into a uniform unsteady flowing ambient where diffusion is only significant in the cross-stream direction. Considering the case of a sinusoidal variation of velocity along the streamwise principal axis, it has been shown that the expected concentration at a source located in a typical flow field may increase by as much as 15% per cycle over that predicted by the near-field model. A hypothetical outfall was analyzed using real data and a dispersion model which accounts for the near-, as well as far-field mixing. The near-field model was found to underestimate the average dilution at the source by about 21%. Extreme values were also underestimated. The results of this study indicate that a complete dispersion model should be used in predicting dilutions in outfall mixing zones of coastal regions. (Author's abstract)
W86-01727

SIMULATION OF TWO-FLUID RESPONSE IN VICINITY OF RECOVERY WELLS,
Lehigh Univ., Bethlehem, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-01733

OCCURRENCE AND DISSIPATION OF HIGH LEAD LEVEL EPISODES IN THE LOWER MISSISSIPPI RIVER,
Louisiana State Univ., Baton Rouge. Dept. of Chemistry.
I. A. Kahwa, and E. J. Newchurch.
Journal of Environmental Sciences and Health, Vol. A20, No. 4, p 395-417, 1985. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Lead, *Heavy metals, *Mississippi River, Water pollution, Path of pollutants, Metals, Fate of pollutants.

Previous investigations involving lead in the lower Mississipi River generally reported low levels, prompting the conclusion that human activity has not resulted in undesirable lead levels in the river water. Our studies reveal that of 435 samples collected between 1978 and mid-1983 from stations at river miles 266, 202, 147, 120, 75 and 49, about 9% had total lead levels exceeding the EPA allowable for drinking water. These values include one of 10,000 micro-g/l and 5 larger than 500 micro-g/l (10 times the EPA allowable). On the basis of the observed variability of lead levels in time and distance, it is concluded that (a) the high lead levels are associated with the Lutcher-Luling-Belle Chasse river stretch (i.e., river miles 147-75); (b) the problem is a result of human activity; and (c) there are mechanisms for the relatively rapid removal of lead and/or dilution of high-lead episodes as the river water flows down stream. (Author's abstract)
W86-01735

EXPERIMENTAL INVESTIGATION OF SOLUTE TRANSPORT IN STRATIFIED POROUS MEDIA; 1. THE NONREACTIVE CASE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W86-01775

EXPERIMENTAL INVESTIGATION OF SOLUTE TRANSPORT IN STRATIFIED POROUS MEDIA 2. THE REACTIVE CASE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W86-01776

STREAMFLOW NITROGEN LOSS FOLLOWING FOREST FERTILIZATION IN A SOUTHERN VANCOUVER ISLAND WATERSHED,
Pacific Forest Research Centre, Victoria (British Columbia).
E. D. Hetherington.
Canadian Journal of Forest Research, Vol. 15, No. 1, p 34-41, February, 1985. 5 Fig, 6 Tab, 33 Ref.

Descriptors: *Fertilization, *Nitrogen, *Forest watersheds, *Vancouver Island, *British Columbia, Fir trees, Water quality, Urea, Ammonia, Nitrates, Fate of pollutants, Nitrification, Streams.

Water quality was monitored in the Lens Creek watershed on southern Vancouver Island (British Columbia) to determine nitrogen loss following fall application of 224 kg N/ha urea fertilizer on a second-growth Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) forest. Peak nitrogen concentrations measured in two small tributary stream
14 mg/L as urea, 1.9 mg/L as ammonia, a
mg/L as nitrate. For the first 14 months, est
nitrogen outputs in excess of background a
were 5.9 and 14.5% of the total applied n
for the two subsidiary watersheds with 46 an
of their drainage areas fertilized, respec
These losses were considerably higher
amounts of less than 1% previously repor
western North America. Increased levels of
and ammonia N were short-lived, while ni
remained above background levels for the
duration. Reasons for the high nitrogen l
clude nitrification of the urea during 7 w
mild, dry weather following fertilization, p
of alder and swampy areas adjacent to the s
high soil permeability, steep slopes, and ab
above average early winter rainfall. The
sheds had been previously fertilized, but an
ence of this first fertilization on nitrog
during the present study in unknown. Lens
water quality was not adversely affected
fertilization in terms of drinking water stand
toxicity to fish. (Author's abstract)
W86-01784

**DISTRIBUTION OF POLYCYCLIC AR
IC HYDROCARBONS IN THE SUR
SEDIMENTS OF PENOBSCOT BAY (
USA) IN RELATION TO POSSIBLE SO
AND TO OTHER SITES WORLDWIDE,**
Bigelow Lab. for Ocean Sciences, West Bo
Harbor, ME.
A. C. Johnson, P. F. Larsen, D. F. Gadbois,
A. W. Humason.
Marine Environmental Research, Vol. 15,
1985. 2 Fig, 2 Tab, 31 Ref. NOAA-NMFS
NA-80-FA-C-0008.

Descriptors: *Polycyclic aromatic hydro
*Sediments, *Penobscot Bay, *Maine, Hy
bons, Aromatic compounds, Air pollution,
late matter, Combustion products, Water p
sources.

Sediments from the Penobscot Bay regio
Gulf of Maine were analyzed by high
liquid chromatography and gas chromato
mass spectrometry for polycyclic aromatic
carbons (PAHs). Total PAH concer
ranged from 286 to 8794 ppb (dry weig
formed a distinct gradient decreasing
from the head. Gradients of decreasing co
tion were also measured in the various ha
the bay. PAH composition was uniform t
out Penobscot Bay. Atmospherically tra
particulate combustion products are hypo
as a major source of PAH contamination. S
tary PAH concentrations from around th
which have been reported in the litera
compiled in a table. PAH levels in Penobs
sediments fall within the range found in in
ized regions throughout the world and ar
cantly higher than would be expected for
previously considered to be uncontaminat
thor's abstract)
W86-01795

**TRACE METALS AND HYDROCARB
SEDIMENTS FROM THE SOUTHA
WATER REGION, WITH PARTICULA
ERENCE TO THE INFLUENCE OF C
FINERY EFFLUENT,**
Southampton Univ. (England). Dept. of G
raphy.
H. Armannsson, J. D. Burton, G. B. Jones,
H. Knap.
Marine Environmental Research, Vol. 15,
1985. 2 Fig, 2 Tab, 35 Ref.

Descriptors: *Trace metals, *Hydrocarbon
ments, *Southampton Water, *England,
environment, Oil refineries, Effluents,
Nickel, Copper, Zinc, Silver, Cadmium,
Water pollution sources.

The concentrations of a number of trac
(Co, Ni, Cu, Zn, Ag, Cd and Hg) ha
determined in sediments from cores col
the Southampton Water region (England

nts of total hydrocarbons were also made on
l of the cores. Markedly elevated concentra-
f copper, up to 362 micro-g/g dry wt, were
in sediments which were collected close to
scharge points of oil refinery outfalls and
also showed concentrations of total hydro-
s considerably greater than the background
for the estuary. The results of selective
al extractions showed that much of the
was present in the non-lattice fraction of
iment. Although the concentrations of Co,
, and Cd were significantly correlated with
f copper in the core showing the highest
trations of this element, these metals were
anced in comparison with the levels found
al other parts of the estuary. Variations in
trations of metals in sediments throughout
ary were not correlated with differences in
carbon content. (Author's abstract)
797

**DE CONTROL OF CADMIUM AND
R CONCENTRATIONS IN ANAEROBIC
RINE SEDIMENTS,**
State Univ., Corvallis. Dept. of Civil Engi-

vies-Colley, P. O. Nelson, and K. J.
on.
Chemistry, Vol. 16, No. 2, p 173-186, 1985.
Tab, 35 Ref.

ors: *Sulfides, *Cadmium, *Copper, *An-
conditions, *Sediments, *Estuarine envi-
Geochemistry, Chemical reactions, Trace
Heavy metals, Iron sulfide, Metals, Pore
ate of pollutants.

um concentrations of the toxic trace
pper and cadmium were calculated for
sico-chemical conditions characterizing
ers of anaerobic estuarine sediments using
thermodynamic data and assuming simple
inerals control solubilities. Polysulfide
s are responsible for the solubility of
n the cuprous (Cu(I)) oxidation state.
d copper concentrations, assuming covel-
) is the controlling solid phase, are in
e agreement with copper analyses in a
ge of sulfidic waters and sediment pore
the absence of thermodynamic data, no
could be taken of possible polysulfide
of cadmium. However, bisulfide com-
ear to account satisfactorily for observed
assuming the existence of greenockite
the controlling solid phase. Anaerobic
sediments may act as a sink for copper
ium in the common situation in which
e concentrations are controlled by the
e of iron sulfide and iron oxide minerals.
where free sulfides reach high concen-
0.001 M or more the concomitant in-
oncentration of bisulfide and polysulfide
may result in the sediments acting as a
opper and cadmium. (Author's abstract)

**ILAR CHARACTER OF THE PROP-
OF A DENSITY FRONT IN A SHAL-
ER BODY,**
Nauk SSSR, Moscow. Inst. Okeanolo-

yanoi, and G. I. Shapiro.
ources, Vol. 11, No. 4, p 335-342, July-
984. 6 Fig, 14 Ref. Translated from
sursy, No. 4, p 82-89, July-August 1984.

: *Water intrusions, *Density fronts,
Heated water, *Power plants, Thermal
aminar flow, Viscosity, Shallow water.

used by differences in the density of
water masses occur during discharge
aters by electric power stations and
terprises, penetration of sea water as a
into river estuaries and for other rea-
ited works on slow intrusions, both
l and theoretical, pertain to the case of
er body, when the viscous boundary
ot have time to spread to the bottom
haracteristics time of evolution of the
all changes in the velocity of the fluid
are concentrated near the intrusion layer. More complex is the case of slow fluid flows in a shallow water body, when the boundary layers spread relatively rapidly, so that the vertical velocity gradients in any layer and bottom friction can no longer be neglected. Such a case was theoretically examined on a model of a two-layer stratified fluid. If the frontal surface intersects the free surface of the fluid or the bottom, forming a front, then the equations describing the evolution of the frontal surface are essentially nonlinear, since in the zone of the front the thickness of the corresponding fluid layer vanishes. Therefore the deviations of the frontal surface from an equilibrium position are comparable with the thickness of one of the layers and they cannot be considered small. Consequently linearization of the equations near the front is inadmissible. Nevertheless, in certain cases it is possible to obtain a number of results analytically and to compare theory and experiment. Particular concern in this work centers on the slow plane-parallel flows of a viscous incompressible two-layer density-stratified fluid in a shallow water body. (Baker-IVI)
W86-01807

EFFECT OF THE CONTENT OF ORGANIC MATTER IN SOIL ON LEACHING OF CHEMICAL FERTILIZERS INTO THE ZONE OF AERATION AND GROUNDWATERS,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
M. V. Lola, N. P. Akhmet'eva, and Yu. A. Medovar.
Water Resources, Vol. 11, No. 3, p 223-227, May-June, 1984. 2 Fig, 4 Tab, 4 Ref. Translated from Vodnye Resursy, No. 3, p 68-72, May-June, 1984.

Descriptors: *Organic matter, *Soil, *Leaching, *Fertilizers, Groundwater pollution, Aeration zone, Nitrogen, Potassium, Phosphorus, Sediments.

To study the possibility of the penetration of fertilizer components into groundwaters, experiments were conducted on the application of fertilizers at rates of 100 kg/ha of active ingredient of each fertilizer. In field experiments, increasing rates of organic sediments, from 50 to 2000-3000 tons/ha, were applied to the soil. The yield of barley grain increased, and simultaneously the mobility of biogenic elements in the soil decreased. The soil application of organic sediments in amounts greater than 500 tons/ha is economically unprofitable, and technically difficult to accomplish. Application rates of organic sediments less than 500 tons/ha do not produce sufficiently high yields. The effect of organic sediments applied to the soil on its adsorbing capacity for chemical fertilizers was studied. An increase in the content of organic matter in soil led to retention of ammonium and nitrate nitrogen in the zone of aeration. Without the application of bottom sediments, the concentration of nitrate nitrogen was at the usual level found in unfertilized soil. Generally, an increase in the content of nitrogen, phosphorus, and potassium was observed in the plow layer with increased application rates of organic matter. The exception was water soluble potassium, the content of which was minimum in the variant with the maximum application rate of organic matter. A decrease in leaching of biogenic elements was noted with an increase of application rate of organic sediments, except nitrate nitrogen. (Baker-IVI)
W86-01822

PHOTOCHEMICAL BEHAVIOR OF CHLORSULFURON IN WATER AND IN ADSORBED PHASE,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Oekologische Chemie.
M. Herrmann, D. Kotzias, and F. Korte.
Chemosphere, Vol. 14, No. 1, p 3-8, 1985. 3 Fig, 15 Ref.

Descriptors: *Photochemistry, *Chlorsulfuron, *Fate of pollutants, Herbicides, Natural waters, Solar radiation, Ultraviolet radiation, Photosensitivity, Fate of pollutants.

The photochemistry of the herbicide chlorsulfuron (2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazinyl-2-amino)carbonyl)benzene sulfonamide) was investigated in methanol, distilled water, natural creek-water, on silica gel and on montmorillonite surfaces. Two major photoproducts were identified in all cases. Under indoor conditions half-lives of chlorsulfuron were 92 hr in methanol, 78 hr in distilled water but only 18 hr in natural creek water. On silica gel the half-life was 60 hr while on montmorillonite powder the half-life was slightly prolonged (66 hr). This ranking of the photostability in different media was confirmed by a series of outdoor experiments under solar radiation conditions. Assuming first order kinetics the half-life times were calculated as 186 hr for distilled water, 31 hr for creek water, 136 hr for silica gel and 115 hr for montmorillonite. The stability of chlorsulfuron in methanol or water can be easily explained by the ultraviolet spectra of the compound. The significant accelerated breakdown rate in creek water samples must be due to their content of photosensitizing agents or to the generation of OH-radicals and other reactive species. (Moore-IVI)
W86-01849

RING TEST OF A METHOD FOR ASSESSING THE PHOTOTRANSFORMATION OF CHEMICALS IN WATER,
European Chemical Industry Ecology and T9oxicology Centre, Brussels (Belgium).
J. Lemaire, J. A. Guth, O. Klais, J. Leahey, and W. Merz.
Chemosphere, Vol. 14, No. 1, p 53-77, 1985. 2 Fig, 10 Tab, 14 Ref.

Descriptors: *Photochemistry, *Pentachlorophenol, *Dichlorophenol, *Dichloroaniline, *Nitrophenol, Phenols, Anilines, Fate of pollutants, Computers.

Seven types of apparatus have been used to measure the quantum yields for direct phototransformation in water of 4 chemicals (pentachlorophenol; 2,4-dichlorophenol; 3,4-dichloroaniline; 4-nitrophenol) under polychromatic (12 laboratories) and monochromatic (3 laboratories) light, according to a common test protocol. The results with both types of light were in good agreement. The reproducibility and accuracy of quantum yields obtained with the ECETOC/University of Clermont-Ferrand apparatus with polychromatic light (6 laboratories) were similar to or better than those obtained with monochromatic light. A disadvantage of the method with polychromatic light is that the calculation is more complicated, but this can be overcome by the use of a desk-top computer. On the other hand experiments with polychromatic light permit the determination of quantum yields of substances of low photo-reactivity. (Author's abstract)
W86-01850

EFFECT OF HYDROCARBON MIXTURES ON ADSORPTION OF SUBSTITUTED NAPHTHALENES BY CLAY AND SEDIMENT FROM WATER,
Virginia Inst. of Marine Science, Gloucester Point.
W. G. MacIntyre, and P. O. deFur.
Chemosphere, Vol. 14, No. 1, p 103-111, 1985. 1 Fig, 5 Tab, 9 Ref.

Descriptors: *Naphthalenes, *Hydrocarbons, *Adsorption, Clay, Sediments, Fuel, Fate of pollutants, Mixtures, Isotherms.

Similarity of adsorption coefficients for a compound from hydrocarbon mixtures in water solution and from the single compounds in water solution would indicate that different hydrocarbons at low concentrations do not compete for adsorption sites when surface coverage is imcomplete, and that the hydrocarbons do not interact in aqueous solution. Adsorption of methyl and dimethyl napthalenes, and of these compounds as components of JP8 aviation fuel and synthetic jet fuel mixtures, was measured on two sediments and montmorillonite clay in water. Isotherms were linear, and hydrocarbons of similar structure gave similar adsorption coefficients on a particular clay or sediment. Individual component adsorption co-

efficients were dependent upon mixture composition, but coefficients usually varied by less than a factor of two. This implies that single component adsorption coefficients may be adequate for use in environmental fate models of hydrocarbon mixtures. It is probable that results obtained pertain to mixtures containing other non-polar solutes such as chlorinated hydrocarbons. (Moore-IVI)
W86-01852

FATE AND TOXICITY OF HIGH DENSITY MISSILE FUELS RJ-5 AND JP-9 IN AQUATIC TEST SYSTEMS,
Georgia State Univ., Atlanta. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-01854

EFFECT OF FLOOD CONDITIONS ON THE GROUNDWATER QUALITY OF A BOREHOLE AT BARODA NEAR CRADOCK, EASTERN CAPE PROVINCE,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Geology.
E. A. W. Tordiffe, W. A. Van Der Westhuizen, and H. De Bruiyn.
Water S. A., Vol. 11, No. 1, p 33-34, January, 1985. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Floods, *Groundwater pollution, *Baroda, *South Africa, Irrigation effects, Chlorides, Sulfates, Sodium, Salts.

Analyses of groundwater samples taken at various time intervals over a period of several months from a single borehole, proved that significant changes in the inorganic quality occurred after periods of extreme flood conditions. The main changes which occurred, one and a half months after devastating floods, were an increase in the Cl(-), SO4(2-) and Na(+) concentration, while only a slight decrease in the HCO3(-) concentration was detected. This phenomenon is attributed to accumulation of salts in the soils and rocks above the groundwater table during normal conditions and the flushing thereof due to extremely wet conditions. The present practice of over-irrigation in the area due to readily available Orange River water could simulate similar flood conditions. (Author's abstract)
W86-01860

WATER QUALITY OF A SMALL URBAN CATCHMENT NEAR DURBAN, SOUTH AFRICA,
Durban-Westville Univ. (South Africa). Dept. of Geography.
G. du T. De Villiers, and E. Malan.
Water S. A., Vol. 11, No. 1, p 35-40, January, 1985. 2 Fig, 3 Tab, 15 Ref.

Descriptors: *Water pollution sources, *Catchment area, *Urban areas, *South Africa, Water quality, Wastewater pollution, Dissolved solids, Sodium, Chlorides, Ammonium, Industrial wastes, Swimming pools.

A preliminary study of baseflow water quality was conducted at a small urban catchment about 15 km northwest of Durban, South Africa. An attempt was made to explain the variations in anion and cation concentrations through on site inspections and discussions with the relevant local authorities. The geological formations in the catchment, consisting mainly of Table Mountain Sandstone, have a limited effect on the water quality. Pollution in the catchment is rather the determining agent. Mineralization of the surface waters is still reasonably low, with the mean total dissolved solids for the period at all the sampling points at 185 mg/l. The waters are dominated by sodium with the relative concentrations Na>Ca>Mg>K. The relatively high chloride content measured at some stations in a residential area could possibly be attributed to swimming pool effluent. The high SO4 concentration at one station is due to spillage by at least two industrial concerns. The relatively high NH4-N concentration at some sampling stations could be due to spillage from an industry and seepage from sewerage overflow. (Moore-IVI)
W86-01861

CHEMICAL COMPOSITION OF TRANSKEI RIVER WATER,
Durban-Westville Univ. (South Africa). Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W86-01862

DEPOSITION AND PROCESSING OF AIRBORNE NITROGEN POLLUTANTS IN MEDITERRANEAN-TYPE ECOSYSTEMS OF SOUTHERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Riverside, CA.
P. J. Riggan, R. N. Lockwood, and E. N. Lopez.
Environmental Science and Technology, Vol. 19, No. 9, p 781-789, 1985. 5 Fig, 5 Tab, 42 Ref.

Descriptors: *Air pollution, *Nitrates, *Atmospheric deposition, *California, Water pollution sources, Groundwater pollution, Streamflow, Throughfall, Precipitation, Fire, Chaparral, Grasslands.

Atmospheric nitrogen deposition, associated with chronic urban air pollution, has produced stream water nitrate concentrations as high as 7.0 mg of N/L in chaperral watersheds in the San Gabriel Mountains of Los Angeles County, CA. Stream water NO3(-) concentration and discharge were greatest at high flow and may contribute significantly to existing groundwater NO3(-) pollution. Annual NO3(-) discharge ranged from 0.04 to 10.0 kg of N/ha over 4 years. Canopy throughfall and precipitation inputs of 23.3 and 8.2 kg of N/ha/year were high relative to other undisturbed ecosystems nationwide. Dry deposition was apparently a major source of the throughfall nitrogen. NO3(-) concentrations from nearby, relatively unpolluted watersheds were lower by 1-3 orders of magnitude. NO3(-) yield was elevated on watersheds where chaparral was converted to grassland in 1960 and may be greatly accelerated after wildfire because of high postfire NH4(+) concentrations and rapid nitrification in terrestrial and aquatic ecosystems. (Author's abstract)
W86-01868

SORBENT CONCENTRATION EFFECTS IN LIQUID/SOLID PARTITIONING,
Michigan State Univ., East Lansing. Dept. of Civil and Environmental Engineering.
T. C. Voice, and W. J. Weber.
Environmental Science and Technology, Vol. 19, No. 9, p 789-796, 1985. 8 Fig, 4 Tab, 22 Ref.

Descriptors: *Lake sediments, *Sorption, *Model studies, *Partition coefficients, Lake Michigan, Hexachlorobiphenyl, Trichlorobiphenyl, Naphthalene, Chlorobenzene, Organic matter.

Partition coefficients developed in laboratory sorption studies have been observed to vary inversely with the concentration of sorbent solids utilized in the experimental system. A model was developed that relates this phenomenon to the complexation, or binding, of the solute by nonseparable organic matter in the liquid phase, and the subsequent sorption of both free and bound solute. It can be shown that linear partitioning in the resulting bisolute system can produce the nonlinear sorption anomalies that have been observed in isotherm studies. The model was calibrated to previously reported sorption data involving four hydrophobic environmental contaminants - 2,4,5,2',4',5'-hexachlorobiphenyl, 2,5,2'-trichlorobiphenyl, naphthalene, and chlorobenzene - and three Lake Michigan sediment samples. The strengths and weaknesses of the model along with its environmental implications are discussed. (Author's abstract)
W86-01869

BIOAVAILABILITY AND BIOTRANSFORMATION OF AROMATIC HYDROCARBONS IN BENTHIC ORGANISMS EXPOSED TO SEDIMENT FROM AN URBAN ESTUARY,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
U. Varanasi, W. L. Reichert, J. E. Stein, D. W. Brown, and H. R. Sanborn.
Environmental Science and Technology, Vol. 19, No. 9, p 836-841, 1985. 2 Fig, 4 Tab, 24

Descriptors: *Benthic fauna, *Bioavaila
*Biotransformation, *Aromatic compounds,
drocarbons, Estuarine environment, Sedi
Urban areas, Benzo(a)pyrene, Crustaceans,
Shrimp, Fish, Metabolism.

Phylogenetically diverse benthic organisms
phipods (Rhepoxynius abronius and Eohau
washingtonianus); clams (Macoma nasuta);
(Pandalus platyceros); fish (Parophrys ve
were exposed to an urban estuarine sedime
ppm of two to six benzenoid ring aromatic
carbons (AHs)) to which trace amounts
3)benzo(a)pyrene (BaP) were added. The
niques used to assess uptake and metabol
AHs were gas chromatography/mass spectro
(GS/MS) for AHs, high-pressure liquid ch
tography/fluorescence spectrometry for AH
bolites in fish bile, and radiometric analy
biotransformation of (H-3)BaP. Generall
extent of metabolism of (H-3)BaP (M. nasut
washingtonianus < R. abronius < or = P.
ceros approximately = P. vetulus) was neg
correlated to tissue concentrations of AHs
to six ring), except that amphipod species a
lated higher concentrations of AHs than did
indicating, that other factors (e.g., feeding
and rate of excretion) also influenced accum
of AHs. Radiometric and GC analyses for
both sediment and tissues suggested that no
the BaP (and presumably other AHs) ex
chemically from sediment was bioavailable
thor's abstract)
W86-01873

**CHLORINATED HYDROCARBON CY
IN THE BENTHIC NEPHELOID LAY
LAKE SUPERIOR,**
Minnesota Univ., Minneapolis. Dept. of C
Mineral Engineering.
J. E. Baker, and S. J. Eisenreich.
Environmental Science and Technology,
No. 9, p 854-861, 1985. 6 Fig, 2 Tab,
NOAA project R/Cl-10, NOAA grant NA
D-00056, EPA grant Cr 810274.

Descriptors: *Benthic nepheloid layer, *Ch
ed hydrocarbons, *Lake Superior, Path of
ants, Polychlorinated biphenyls, DDE, He
obenzene, Resuspension, Lake sediments.

The dynamics and composition of the ben
pheloid layer (BNL) in western Lake S
were studied with respect to the cycling
hydrophobic organic compounds. The BN
enriched in t-PCB, p,p'-DDE, and hexachl
zene (HCB) but deficient in dissolved
carbon relative to surface waters. Resus
events in midsummer resulted in a 50% inc
the PCB burden in the water column. S
cycling of PCB congeners was strongly de
on their degree of chlorination, with heavie
inated congeners lost from the water colu
= 17-28 days at two sites). Steady-state
concentrations in the BNL were maintain
the summer by transport of lighter chl
congeners from the underlying sediments.
an effective tracer of sediment resuspe
Lake Superior. Recycling of trace organic
ants in the BNL serves to increase their r
times in the lake. (Author's abstract)
W86-01875

**LAGRANGIAN MULTI-LEVEL MOD
TRANSPORT, TRANSFORMATION AN
OSITION OF ATMOSPHERIC SULFU
IDE AND SULFATE,**
Akademie der Wissenschaften der DDR,
Forschungsstelle fuer Chemische Toxikolo
E. Renner, U. Ratzlaff, and W. Rolle.
Atmospheric Environment, Vol. 19, No. 8,
1359, 1985. 6 Fig, 3 Tab, 16 Ref, 1 Append.

Descriptors: *Lagrangian transport mode
of pollutants, *Sulfur dioxide, *Acid de
*Acid rain, Model studies, Sulfates, Preci
Air pollution, Water pollution sources.

i-level Lagrangian atmospheric model for rt, transformation and dry and wet deposi- sulfur dioxide and sulfate is described. All es are assumed to be reactions of the first The rate constants vary diurnally and sea- with different meteorological conditions. iability of the concentration in the surface as demonstrated by two examples, near the In one, dispersion within 100 km of a s considered and in the other the variation me fraction of S during long-range trans- alculated. This gives some insight into the ily complex considerations required in obtain optimal arrangements for environ- rotection when near- and far-field source re operating at the same time. The model sed in a simple programmable desk calcu- hout too much expense. (Baker-IVI)
83

TELEMETRY AS AN AID TO ENVI- NTAL CONTAMINANT EVALUATION ILE WILDLIFE SPECIES,
Pacific Northwest Labs., Richland, WA.
ary bibliographic entry see Field 7B.
6

IINANT RESIDUES IN FISH AND NTS FROM LAKES IN THE ATCHA- RIVER BASIN (LOUISIANA),
National Fisheries Research Lab., MO.
ger, and J. K. Andreasen.
of Environmental Contamination and y, Vol. 14, No. 15, p 579-586, Septem- 2 Fig, 3 Tab, 26 Ref.

rs: *Fish, *Lake sediments, *Pesticide Metals, *Atchafalaya River Basin, *Lou- nd use, Agriculture, Overflow, DDT, ychlorinated biphenyls, Water pollution nimal tissues.

n of bottomland hardwood forests to l land has reduced habitat and water nany lakes in the floodplain of the lower River. The objectives of this study ertain current contaminant residue con- in fish and sediment from lakes in the a River Basin and to determine the in- overflow and agricultural land use on t levels. Fish and sediment samples cted from eight lakes that differed in o overflow, headwater overflow, back- low) and land-use characteristics (pres- ence of agricultural land). Residue anal- ediment and 82 fish samples collected tudy lakes showed that contaminant re uniformly low. Total DDT concen- nsisting mainly of DDE, were found in fish samples and generally were the dues though they rarely exceeded 0.05 Dieldrin, alpha-BHC and gamma-BHC, tions rarely exceeding 0.05 micro-g/g, ed in about 50% of fish samples. Total ine pesticide and PCB residues were 0 micro-g/g in all fish from all lakes, a 3.46 micro-g/g total in spotted gar oculatus) from one lake. Sediments om pesticide residues except for occa- (0.01 micro-g/g) of alpha-BHC. Metal entrations in fish and sediment samples of uncontaminated areas. Lake sys- tchafalaya River Basin appeared to be ncontaminated by agricultural pesti- etal and organic residues in fish were lakes with the same land-use and racteristics. (Author's abstract)

ANTS IN FISH FROM GREAT ARBORS AND TRIBUTARY

al Protection Agency, Chicago, IL. National Program Office.
t.
Environmental Contamination and Vol. 14, No. 5, p 587-594, September, 6 Ref.

*Great Lakes, *Pesticides, *Priority *Fish, Polychlorinated biphenyls, Chlorinated hydrocarbons, Aromatic compounds, Aliphatic compounds, Benzene compounds, Rivers, Tributaries, Harbors.

Composite fish samples collected from Great Lakes harbors and tributaries between 1980 and 1981 were analyzed by gas chromatography and gas chromatography-mass spectrometry for a wide range of pesticides and priority pollutants. Severe polychlorobiphenyl (PCBs) contamination was observed in Sheboygan River fish with moderate to severe PCB contamination in samples from the Milwaukee, Kinnickinnic, Fox, and Ashtabula Rivers. The Ashtabula River samples also contained several chlorinated aromatic and aliphatic hydrocarbons. Polynuclear aromatic hydrocarbons were detected in fish from the Black, Kinnickinnic and Menominnee Rivers, while a number of benzene derivatives were observed in samples from the Fox and Wolf Rivers. (Author's abstract)
W86-01891

TEMEPHOS RESIDUES IN STAGNANT PONDS AFTER MOSQUITO LARVICIDE APPLICATIONS BY HELICOPTER,
Environmental Research Lab., Gulf Breeze, FL.
E. M. Lores, J. C. Moore, P. Moody, J. Clark, and J. Forester.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 308-311, September, 1985. 2 Fig, 10 Ref.

Descriptors: *Temephos, *Pesticide residues, *Water analysis, *Water pollution effects, Water pollution sources, Insecticides, Organophosphorus compounds, Organic compounds.

The concentrations of temephos in water were measured so that the application rates could be confirmed for this organophosphate insecticide to control mosquito larvae. Results are reported from residue analysis of water from two stagnant ponds following actual field applications of larvicide by helicopter at treetop level in South Florida. Site 1 was less than 0.05 ha in surface area, less than 10 cm deep, and completely covered by a tree canopy. Site 2 was greater than 0.5 ha in surface area, less than 10 cm deep and the canopy was open in the middle. The recommended application rate on the label of the 4-E formulation for mosquito larvae control is 0.5 to 1.5 fl oz/acre. Calculated residue concentrations for the intended 1 oz/acre application rate used in the study range from 250 micro-g/l for water that is 1 inch deep to 42 micro-g/l for waters that are 6 inches deep. These calculations predict concentrations of temephos that are very close to the measured concentration found immediately after the sprays. Field test results indicate that the pesticide remains intact in water up to 48 hours, and residues as high as 62 micro-g/l are found. A problem of stabilization in this study was overcome by using mineral oil as an extracting solvent until the samples could be returned to the laboratory. (Baker-IVI)
W86-01897

ORGANOCHLORINE HYDROCARBON RESIDUES IN SEDIMENTS OF TWO DIFFERENT LAGOONS OF NORTHWEST MEXICO,
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Ciencias del Mar y Limnologia.
M. T. L. Rosales, R. L. Escalona, R. M. Alarcon, and V. Zamora.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 322-330, September, 1985. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Lagoons, *Mexico, *Yavaros lagoon system, *Huizache-Caimanero lagoon system, *Sediments, *Organic compounds, *Chlorinated hydrocarbons, Hydrocarbons, Salinity, Seasonal variation, Pesticide residues, DDT.

Sediment samples were collected seasonally during a 21 month period from the Yavaros lagoon system in Sonora Mexico and the Huizache-Caimaneros lagoon system in Sinaloa Mexico. The concentration of organochlorine residues at each sampling station was determined. Higher concentrations of organochlorine compounds in the Yavaros area were usually found from October to January. However there was not a clear distribution pattern. The highest values observed were: HCH 10.45, heptachlor 5.4, aldrin 1.85, heptachlor epoxide 4.29, dieldrin 5.85, and total DDT 7.62 micro-g/kg. The values are higher in Moroncarit lagoon and in the estero linking Moroncarit and Yavaros lagoons. Yavaros lagoon has a uniform salinity of about 37% which reflects a high marine influence. Organochlorine hydrocarbons concentration in the Huizache-Caimanero system is higher in July. The concentration of these compounds apparently follows an annual cycle which is related to the evaporation-precipitation cycle of these lagoons. The persistence of HCH in submerged tropical soils is not very long due to the microflora degradation of this compound. The cycling presence of DDT in the Huizache-Zaimanero system was unexpected. The levels of organochlorine compounds determined in the areas studied are within the same order of magnitude as those reported earlier. Total DDT values ranged from 3 to 21 micro-g/kg. (Baker-IVI)
W86-01899

EFFECTS OF GUT SEDIMENT CONTENTS ON MEASUREMENT OF METAL LEVELS IN BENTHIC INVERTEBRATES - A CAUTIONARY NOTE,
E.V.S. Consultants Ltd., North Vancouver (British Columbia).
P. M. Chapman.
Bulletin of Environmental Contamination and Toxicoloy, Vol. 35, No. 3, p 345-347, September, 1985. 1 Tab, 5 Ref.

Descriptors: *Sediments, *Metals, *Invertebrates, *Benthic fauna, Copper, Zinc, Lead, Iron, Manganese, Nickel, Cobalt, Tubificids, Larvae, Lampreys, Midges.

Sediments were collected subtidally in the Lower Fraser River, British Columbia for metal analysis. Three groups of organisms were collected in sufficient biomass for heavy metals analysis. Gut sediment weight of tubificids averaged 14.99% of total weight, however the metal load contributed by the gut sediment varied from a mean value of 16.4% for zinc to a mean value of 39.7% for nickel. In the case of ammocoetes larvae, average gut sediment weight was less than that for tubificids, but the metal load contributed by this sediment was much higher than in tubificids. Values varied from a mean of 20.7% for zinc to a mean of 62.0% for lead. Chironomid larvae were only occasionally collected so the sample size is small, but gut sediment metal contents also comprised a high percentage of the total metal load. It is important that digestions of whole benthic animals for tissue metal analysis include a gut sediment correction. (Baker-IV)
W86-01902

SUPERFICIAL ACCUMULATION OF HEAVY METALS IN NEAR SHORE MARINE SEDIMENTS: AN OBJECTIVE INDEX OF ENVIRONMENTAL POLLUTION,
Instituto de Investigaciones Pesqueras, Cadiz (Spain).
R. Establier, A. Gomez-Parra, and J. Blasco.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 348-353, September, 1985. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Bay of Cadiz, *Spain, *Heavy metals, *Marine sediments, *Sediments, Vertical distribution, Fate of pollutants, Zinc, Manganese, Iron, Copper, Lead, Cadmium, Salt ponds, Aquaculture.

The effect of civilization has been evaluated in the Bay of Cadiz, Spain. This area represents a densely populated and relatively enclosed coastal zone having a special interest due to the use of its salt ponds as fish farms. The vertical distribution of six heavy metals and other complementary parameters were studied at a few sampling-stations, chosen as representative sedimentary environments of this zone. A Superficial Enrichment Factor was established. In general, the content of organic carbon

and heavy metals in the sediments of this zone appeared to be determined by the granulometry of the bottom, although the vertical trend of these parameters is conditioned by the proximity of the sample station to the outlets of the urban and industrial effluents of the area. The most pronounced concentration gradients of metals correspond to the northern area, where the greater number of effluents are located. The progressive reduction with depth of typically polluting metals occurs to some extent in all the sampling stations, and an extremely complex situation was found in the more superficial layer, mainly due to changes in the redox conditions of the environment. The Superficial Enrichment Factors Values are quite variable depending on the metal and the sampling station considered. The quantities of iron and manganese have not increased greatly in recent years. In the salt ponds the influence of anthropogenic activity was similar to other places where the movement of the water is not restricted. The complex hydrodynamics of the area may give rise to anomalous distributions for some heavy metals. (Baker-IVI)
W86-01903

ABSORPTION OF CU++ BY LONG-TERM CULTURES OF DUNALIELLA SALINA, D. TERTIOLECTA, AND D. VIRIDIS,
Montclair State Coll., Upper Montclair, NJ. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-01904

ATRAZINE HYDROLYSIS IN SOILS: CATALYSIS BY THE ACIDIC FUNCTIONAL GROUPS OF FULVIC ACID,
Department of Agriculture, Ottawa (Ontario). Chemistry and Biology Research Inst.
D. S. Gamble, and S. U. Khan.
Canadian Journal of Soil Science, Vol. 65, No. 3, p 435-443, August, 1985. 3 Fig, 2 Tab, 25 Ref.

Descriptors: *Atrazine, *Hydrolysis, *Fulvic acid, *Soil water, *Fate of pollutants, Herbicides, Humic substances, Soil solution, Mathematical equations.

The catalysis of atrazine hydrolysis at 25.0 C by the types of acidic functional groups found in humic materials has been investigated. No evidence of catalysis by carboxylate ions was observed. From a knowledge of the types and number of acid functional groups in a quantitatively characterized fulvic acid, and the distributions of their KA values it was found that hydrogen ions and undissociated carboxyl groups were the only catalytic agents. The carboxyl groups have a second-order k sub AH of 7.88/days/M. Weakly acidic functional groups having Ka approximately = 10 to the 10th power showed no catalysis. A predictive equation has been produced for the half-life of atrazine in fulvic acid solutions at 25.0 C. It represents a general class of equations which should permit the practical prediction of atrazine persistence in soil solutions and other natural waters. (Author's abstract)
W86-01907

DISSOLVED COLOURED COMPOUNDS AND SUSPENDED MATTER IN THE WATERS OF THE MIDDLE WAIKATO RIVER,
Department of Scientific and Industrial Research, Taupo (New Zealand). Div. of Marine and Freshwater Sciences.
M. H. Timperley.
New Zealand Journal of Marine and Freshwater Research, Vol. 19, No. 1, p 63-70, 1985. 3 Fig, 1 Tab, 22 Ref.

Descriptors: *Suspended solids, *Color, *Waikato River, *New Zealand, Aromatic compounds, Turbidity, Hydroelectric plants, Organic compounds, Industrial wastewater, Pulp wastes.

Concentrations of suspended matter and filtrable hydroxylated aromatic compounds (HAC) together with turbidity and light absorbance measurements at 270 and 750 nm are reported for monthly samples, over one year, of water from the tailraces of the nine hydroelectric power stations on the Waikato River, North Island, New Zealand. Between Lakes Aratiatia and Karapiro the suspended matter concentrations increase 3-fold. The concentrations of HAC increase only slightly in all lakes except Lake Maraetai where a 3-fold increase occurs because of Kraft bleach effluent from the New Zealand Forest Products Limited, Kinleith Mill. This effluent also causes a marked increase in the absorbance at 270 nm, a measure of the brown color attributable to dissolved organic compounds. The HAC in the effluent are linearly related to absorbance at 270 nm. The use of these easily measured parameters for detecting changes in water appearance, i.e., color and clarity, are discussed. Measurements of light scattering, either turbidity or absorbance, appear to have sufficient sensitivity to detect changes in relative water clarity. The ratio of inorganic to organic suspended matter increases down the river and measurements of these two components could be used to detect changes in water appearance resulting from changes in the suspended matter composition. The absorbance at 270 nm of filtered water is a convenient and sensitive indicator of dissolved color but a range of unidentified compounds contribute to this absorbance and for control of the brown coloration caused by timber processing effluents, limits on the discharge of HAC may be more useful. (Author's abstract)
W86-01912

LEACHING STUDY OF OIL SHALE IN KENTUCKY WITH A SECTION ON HYDROLOGIC RECONNAISSANCE OF THE OIL SHALE OUTCROP IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
S. S. Leung, D. W. Leist, R. W. Davis, and S. Cordivola.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4073, 1984. 68 p, 18 fig, 23 tab, 48 ref.

Descriptors: *Oil shale, *Leaching, *Groundwater, *Surface water, *Water quality, Geology, *Kentucky, Knobs physiographic region, Groundwater movement, *Water pollution sources.

Oil shales in Kentucky are rocks of predominantly Devonian age. The most prominant are the Ohio, Chattanooga, and New Albany Shales. A leaching study was done on six fresh oil shale samples and one retorted oil shale sample. Leaching reagents were distilled water, 0.0005 N sulfuric acid, and 0.05 N sulfuric acid. The concentration of constituents in the leachates were highly variable. The concentration of sodium, manganese, and zinc in the retorted shale leachate was several orders of magnitude higher than those of the leachates of fresh shale samples. The major oil shale outcrop covers approximately 1,000 square miles in a horseshoe pattern from Vanceburg, Lewis County, in the east, to Louisville, Jefferson County, in the west. The Kentucky, Red, and Licking Rivers cross the outcrop belt, the Rolling Fork River flows along the strike of the shale in the southwest part of the outcrop, and the Ohio River flows past the outcrop at the ends of the horseshoe. Oil shale does not appear to significantly alter the water quality of these streams. Oil shale is not an aquifer, but seeps and springs found in the shale indicate that water moves through it. Ground water quality is highly variable. (USGS)
W86-01918

GROUND-WATER QUALITY IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-01919

5C. Effects Of Pollution

EVALUATION ON POLLUTION IN THE XIANG JIANG RIVER BY USING ZOOBENTHOS,
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
For primary bibliographic entry see Field 7B
W86-01323

SPECIES DIVERSITY OF ALGAL FLOR VISHWAMITRI RIVER, BARODA (INDIA
S.S.V.P. Santha's Science Coll., Dhule (
P.G. Dept. of Botany.
For primary bibliographic entry see Field 5A
W86-01325

RECONSTRUCTION OF LONG-TERM SERIES FOR COMMERCIAL FISH ABUNDANCE AND ESTUARINE POLLU LOADINGS,
Martin Marietta Environmental Systems, bia, MD.
J. K. Summers, T. T. Polgar, J. A. Tarr, K. Rose, and D. G. Heimbuch.
Estuaries, Vol. 8, No. 2A, p 114-124, June, Fig, 2 Tab, 37 Ref.

Descriptors: *Estuaries, *Fish populations, pollution effects, *Fisheries, Time series a Climate, Statistical studies.

Time series were developed for five targ aries and 35 target fisheries using as much existing data as can be found on commerci ings, fishing effort, pollution loadings, d mental activities, and habitat alterations. data points from climatic and pollution tim were estimated by statistical modeling, in tion, and assumption. A probabilistic meth developed to estimate relative stock abunda each target species-estuary combination usi arine-specific landings, regional landings, catch-by-gear, and regional effort. Based o all literature, ecological and economic eff commercial fisheries and fishing resource ably result from climatic variations. (Bal
W86-01331

INVESTIGATION OF RELATION AMONG POLLUTANT LOADINGS AN STOCK LEVELS IN NORTHEASTERN ARIES,
Martin Marietta Environmental Systems, bia, MD.
T. T. Polgar, J. K. Summers, R. A. Cummi A. Rose, and D. G. Heimbuch.
Estuaries, Vol. 8, No. 2A, p 125-135, June Fig, 2 Tab, 14 Ref.

Descriptors: *Potomac River, *Fish pop *Time series analysis, *Water pollution eff tuaries, Fish, Climates.

Time series analysis by regression of ca variables seems promising for investigatin ant effects on stocks. The method develo is attractive in that it yields comparative a abilistic measures of pollutant effects re other population control factors. Addition egorical regression models seem to expla spectable amount of stock variability, g limited reliability of landings, effort, and data. These types of analyses will be ext other species, pollutants, and estuaries project progresses. In the current study gorical time series regressions were used preliminary relationships among previous stock size, climatic variables, and pollutio tors. The analysis technique evaluated hy on the effects of human population cha dredging activity on stock histories of the estuary's striped bass and American shad period 1929 through 1976. While climati dominate striped bass dynamics compare two pollution variates tested, the Ameri stock showed strong dependence on hum lation levels, but not on dredging activ pared to climatic factors. (Baker-IVI)
W86-01332

ABUNDANCE FLUCTUATIONS BENTHIC INVERTEBRATES IN TWO IC ESTUARIES,

ical Survey, Menlo Park, CA.
ichols.
es, Vol. 8, No. 2A, p 136-144, June, 1985. 4
) Ref. DOE contract DE-AT06-76EV-
6.

tors: *Estuaries, *Invertebrates, *Benthic
Population dynamics, Water pollution ef-
get Sound, San Francisco Bay.

ting time scales and mechanisms of struc-
riations within two benthic communities
amined using long term studies. The useful-
such long data sets for evaluating human
n a given area were also examined. Large
m variations in species abundances within
unity composed predominantly of oppor-
pecies were revealed in a 10 year study of
ancisco Bay mudflat. This particular study
cated in a highly urbanized estuary where
enced by a nearby sewage treatment facili-
d changes in population size of the
species impedes the detection of anthro-
influences on community composition.
y long term data sets may provide evi-
progressive changes. Numerical abun-
the common species also change marked-
dence by data collected for a 20 year
the benthic community at 200 m depths
in basin of Puget Sound. This environ-
ubject to little apparent habitat disturb-
nerical dominance shifts from one species
r at irregular, multiyear intervals. Recent
in two heretofore rare species, and a
increase in total numbers of individuals
at long term changes may be occurring
mmunity. The importance of measuring
mplitude and the periodicity of fluctua-
pulation size of aquatic species as well as
fluctuations and patterns in environmen-
s before attempting to demonstrate the
nthropogenic influences on aquatic com-
s demonstrated by these two long term
The usefulness of long term data sets for
the potential importance of interactions
ecies in determining abundance patterns
bottom benthos is demonstrated. (Baker-

3

**HICATION AND MANAGEMENT
VES FOR THE CONTROL OF NU-
NPUTS TO RHODE ISLAND COAST-
ONS,**
land Univ., Narragansett. Graduate
Oceanography.
l S. Olsen.
Vol. 8, No. 2B, p 191-202, June, 1985. 2
, 60 Ref. NOAA grant NA-79AA-D-
eral Regional Council Grant FRC-JF-

: *Eutrophication, *Lagoons, *Coastal
node Island, Nutrients, Water pollution
Fisheries, Water pollution effects,
er pollution.

hication of large coastal lagoons in
nd is discussed including definition of
of the problem, identification of the
utrient inputs and development of man-
iatives. The lagoons, known locally as
lie on the glacial outwash plain of
d's south shore and are separated from
narrow coastal barriers. The nitrogen
unit area of the salt ponds are 240-770
sq m per year. Nutrient enrichment of
ns has led to increased growth of
oalgae. This increased growth appears
benthic habitat and shift it from a
detrital food chain which is impacting
t shell fisheries. The major sources of
uts to the salt ponds are identified as
nitrogen inputs from streamflow,
, runoff, precipitation and tidal inflow
re. The groundwater is the dominant
which nitrogen enters the salt ponds.
nanagement initiatives are proposed to
from present and potential develop-
the watersheds of the lagoons. These
cus on two issues. The first is to
nt loadings from already densely developed areas. The second is to reduce the potential for further development in as yet sparsely developed areas within the watershed. The plans call for an aggressive program to maintain existing septic systems and to replace failing systems; to build and maintain settling basins for major sources of surface runoff; to limit extension of sewers into already densely developed areas; to restrict extension of water supply systems to within pond watershed boundaries so that future tie-ins do not withdraw substantial amounts of freshwater influx from one pond and divert it to another; to require buffer strips of natural vegetation around the shoreline of the ponds to minimize runoff and protect intertidal habitat; and to mount a sustained educational campaign to promote public appreciation for the problems and the need to support these measures. (Baker-IVI)
W86-01337

IMPACT OF DISCHARGES FROM SEAFOOD PROCESSING ON SOUTHEASTERN ESTUARIES,
Georgia Univ., Brunswick. Marine Extension Service.
K. W. Gates, B. E. Perkins, J. G. EuDaly, A. S. Harrison, and W. A. Bough.
Estuaries, Vol. 28, No. 2B, p 244-251, June, 1985. 2 Fig, 5 Tab, 20 Ref. National Sea Grant Program grant 04-8-M01-175.

Descriptors: *Georgia, *Food processing wastes, *Estuarine environment, Industrial wastes, Water pollution effects, Nutrients.

The effects of effluents on two of Georgia's estuarine systems were studied. The systems included a relatively undeveloped area consisting of three small estuarine creeks, two of which are normally exposed to seafood packing by-products, and a large commercially and industrially developed estuary that receives effluents from a seafood processing plant and three packing houses. The environmental impact of current seafood processing wastes on estuaries in Georgia appears to be minimal when compared with the natural organic load. The large estuary demonstrated a high residual capacity to receive processing effluents without significant change. The BOD load from shrimp thawing, peeling, sorting, and cleaning operations at the large seafood processing plant was shown to be equivalent to the organic material generated by a 302 sq m plot of salt marsh. NH4-N levels were greater than, but the same order of magnitude as, natural runoff from marsh land. (Baker-IVI)
W86-01340

EFFECTS OF CONTAMINANTS ON TOXICITY OF THE LAMPRICIDES TFM AND BAYER 73 TO THREE SPECIES OF FISH,
National Fishery Research Lab., La Crosse, WI.
L. L. Marking, and T. D. Bills.
Journal of Great Lakes Research, Vol. 11, No. 2, p 171-178, 1985. 4 Tab, 24 Ref.

Descriptors: *Great Lakes, *Lampricides, *Fish, *TFM, *Bayer 73, *Water pollution effects, Synergism, Fish management, Pesticides, Organic compounds, Pesticides, Metals, Industrial wastes, Tannic acid.

Nontarget fish were exposed to combinations of lampricides and contaminants that may be present in the Great Lakes basin, with the objectives of quantifying the additive toxicity of certain paired mixtures, demonstrating the effects of combining two or more selected pesticides, and calling attention to the potential hazards of applying chemicals in aquatic environments where contaminants already exist. The toxicities of combinations of lampricides with organic pesticides, metal, industrial or municipal pollutants, and tannic acid were mostly additive. The toxicity of a combination of TFM, Delnav, and malathion was synergistic, and extremely small quantities of each chemical became lethal when mixed. Toxicities of the pesticides in the combination also increased commensurately. The triple combination of chemicals produced extraordinary synergism and effectively demonstrated the hazards that may result if certain chemical combinations occur in the aquatic environment. Synergism is not the only kind of toxic action that produces hazards to aquatic organisms. All three types of toxic action are of concern because toxic units produced by contaminant chemicals add to the toxic units of applied management chemicals. Since the toxicity of the majority of chemical combinations is simply additive, this cumulative toxic action contributes more total units to aquatic environments than the extreme actions of less than additive and synergism. The toxicity of the lampricide TFM, as well as other management chemicals, is reinforced by the presence of any contaminant that contributes additional units of toxicity. (Baker-IVI)
W86-01349

NUTRIENT ENRICHMENT OF ESTUARINE SUBMERSED VASCULAR PLANT COMMUNITIES. 1. ALGAL GROWTH AND EFFECTS ON PRODUCTION OF PLANTS AND ASSOCIATED COMMUNITIES,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
For primary bibliographic entry see Field 2L.
W86-01351

EFFECTS OF ENVIRONMENTAL AND BIOLOGICAL VARIABLES ON THE TOXICITY OF MERCURIC CHLORIDE,
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, R. Chand, and I. P. Tonk.
Water, Air, and Soil Pollution, Vol. 25, No. 3, p 243-248, July, 1985. 4 Tab, 31 Ref.

Descriptors: *Toxicity, *Mercuric chloride, *Fish, Water pollution effects, Temperature effects, Dissolved oxygen, Acidity, Fish populations.

The effects of environmental and biological variables on the toxicity of mercuric chloride to the fish Notopterus notopterus were evaluated. Temperature, dissolved oxygen concentrations, acidity, and fish size play a major role in the toxicity of mercuric chloride, especially in bioassay tests. Thus these variables need special attention whenever the results of bioassay are given with reference to chemicals. This will also help in determining a more reliable tool for calculation of the maximum allowable toxicant concentration and application factor for chemicals to be used in the field. (Baker-IVI)
W86-01353

EFFECTS OF EFFLUENT OF MUNICIPAL WASTEWATER ON THE GROWTH OF PORPHYRA YEZOENSIS IN THE CASE OF STATIC CULTURE (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan).
T. Maruyama, A. Miura, and T. Yoshida.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 51, No. 2, p 315-320, February, 1985. 9 Fig, 2 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Porphyra, *Macrophytes, *Activated sludge, Salinity, Plant physiology, Plant growth, Absorbance spectra, Spectroscopy.

The effects of unchlorinated activated sludge effluent from a municipal sewage treatment plant on the growth of Porphyra yezoensis were investigated for different effluent dosages with different degrees of salinity by means of in vitro static culture. To clarify the effect of the effluent on the Porphyra thalli, the length of thalli and the absorbance spectra of living thalli were measured every two days. The number of dead cells in a thallus were counted using a microscope 10 days after the start of the culture, followed by a erythrosine staining. While increasing the effluent dosage to about 5% by volume, the relative length of thalli decreased rapidly and the number of dead cells quickly increased, and they were enhanced with the lower salinity. When the effluent dosages was above 5%, the relative length of thalli and the number of dead cell had a definite value for each degree of salinity. The absorbance spectra (350-750 nm) and absorbance ratio (567 nm/676 nm) of living thalli increased when the effluent dosage and

exposure time were increased. The above mentioned results suggest that the activated sludge effluent of municipal wastewater may have an adverse effect on the growth of Porphyra thalli. (Author's abstract)
W86-01363

INVESTIGATIONS ON PARAQUAT TOXICITY IN FISHES,
Jozsef Attila Univ., Szeged (Hungary). Dept. of Biochemistry.
J. Nemcsok, L. Orban, B. Asztalos, Z. Buzas, and A. Nemeth.
Water International, Vol. 1, No. 2, p 79-81, June, 1985. 5 Fig, 12 Ref.

Descriptors: *Herbicides, *Paraquat, *Fish, *Toxicity, Organic compounds, Agricultural chemicals, Water pollution effects, Enzymes.

The sensitivity of three fish species with different feeding habits to paraquat contamination was examined. Treatments with 1 and 10 ppm paraquat, respectively, increased the transaminase enzyme activity of all three fish species investigated to about the same extent. The treatment with 100 ppm (which due to its deadly effect lasted less than 15 minutes) did not result in measurable transaminase increase in any of the species. LDH and blood glucose level proportionally increased with respective paraquat concentration applied, including the lethal 100 ppm treatment. Asphyxia was one of the accompanying symptoms of the sudden death of fishes due to high paraquat concentration. Preceding their death, fish were air-breathing with difficulty and tried to jump out of the aquaria. Scarlet red discoloration of abdominal veins could be noted during post motem examination. The change of serum cholinesterase activity on paraquat treatment of various concentrations differed in two of the fish species; 10 ppm paraquat decreased it by 40% in carp and by 30% in silver carp. The 100 ppm lethal dose also decreased serum cholinesterase activity. The points of paraquat's attack and results of attack include injury of liver and kidneys, reduction of oxygen uptake capacity by damaging the epithelial cells of the gill, and inhibition of cholinesterase enzyme activity, thus causing serious problems to the nervous system. (Baker-IVI)
W86-01378

ACUTE AND SUBLETHAL EFFECTS OF ORGANOTIN COMPOUNDS ON AQUATIC BIOTA: AN INTERPRETATIVE LITERATURE EVALUATION,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
L. W. Hall, and A. E. Pinkney.
Critical Reviews in Toxicology, Vol. 14, No. 2, p 159-209, 1985. 5 Tab, 101 Ref.

Descriptors: *Toxicity, *Water pollution effects, *Reviews, *Organotin compounds, Organic compounds, Metals, Tin, Aquatic life, Zooplankton, Fish, Invertebrates, Phytoplankton, Marine environment, Estuarine environment, Bioaccumulation.

The objectives of this review were to collect, synthesize, and interpret acute and sublethal organotin toxicity data in both freshwater and estuarine-marine ecosystems; to present environmental water column and sediment concentrations of organotin compounds in both freshwater and estuarine-marine systems to facilitate interpretation of toxicity data; and to identify deficiencies in available data to recommend future research for assessing ecological effects of organotin compounds in aquatic systems. Organotin toxicity data were available with 4 phytoplankton species, 5 zooplankton species, 19 species of macroinvertebrates, and 11 fish species. Acute organotin toxicity was found to range from 0.0004 to 0.004 mg/l bis (tributyltin) oxide (TBTO) for several zooplankton species. Acute mortality data for macroinvertebrates ranged from 0.0005 mg/l TBTO for juvenile mysid shrimp, Metamysidopsis elongata, to 0.29 mg/l TBTO for the pacific oyster, Crassostrea gigas. Imposex occurred in the mud snail at TBTO concentrations below the LC50. Bioconcentration-depuration studies with macroinvertebrates were conducted with mud crabs and oysters. Mud crabs exposed to TBTO through both food and water accumulated higher concentrations when compared with exposure through water. The effects of interacting environmental parameters such as temperature and salinity on the toxicity of organotin compounds to macroinvertebrates was also evaluated. Ninety-six hour LC50s for adult estuarine and marine fish ranged fom 0.005 mg/l TBTO for sheepshead minnows to 0.036 mg/l TBTO for the sole. Bioconcentration-depuration studies with sheepshead minnow showed that TBTO did not reach equilibrium in various tissues after 58 days of exposure. Ninety-six hour LC50s for all trophic groups were found to range from 0.0004 to 0.29 mg/l TBTO. Zooplankton were the most sensitive group; bivalves the most resistant. Environmental concentrations of organotin compounds in estuarine and marine water ranged from not detectable to 0.00 mg/l. Higher concentrations of organotin compounds were found in harbor and marina areas. (Baker-IVI)
W86-01400

MORPHOMETRIC ANALYSIS OF THE RESPONSE OF ANABAENA FLOS-AQUAE AND ANABAENA VARIABILIS (CYANOPHYCEAE) TO SELECTED CONCENTRATIONS OF ZINC,
Herbert H. Lehman Coll., Bronx, NY. Dept. of Biological Sciences.
J. W. Rachlin, T. E. Jensen, and B. E. Warkentine.
Archives of Environmental Contamination and Toxicology, Vol. 14, No. 4, p 395-402, July, 1985. 3 Fig, 4 Tab, 31 Ref.

Descriptors: *Anabaena, *Cyanophyta, *Zinc, *Metals, *Toxicity, *Algae, Water pollution effects, Electron microscopy, Plant physiology.

The toxicological responses of the fresh-water cyanophycean algae Anabaena flos-aquae and A. variabilis, to select concentrations of the essential cation zinc, were quantified by the techniques of stereological electron microscopic morphometry. The cation concentrations used were 20.6, 52.0, and 114.7 micro-M, which represented the 96-hr EC50 dose for A. variabilis and an equal bisection of a log scale above and below this concentration. The results indicated that the surface area of the thylakoids of A. flos-aquae were significantly increased after exposure to 114.7 micro-M Zn, and that there was a significant increase in the number of lipid bodies per cell. All test concentrations caused a significant reduction in both the numbers and relative volume of the cell's cyanophycin granules, but resulted in an increase in the cell's membrane limited crystalline inclusions. Both 52.0 and 114.7 micro-M Zn caused a significant increase in the surface area of the thylakoids of A. variabilis, but only the highest concentration caused an increase in the volume of the interthylakoidal spaces. The relative volume and numbers of lipid bodies of A. variabilis cells were increased by exposure to 52.0 micro-M Zn, and 114.7 micro-M Zn caused a significant increase in the relative volume and numbers of the cell's polyphosphate bodies. The significance of these results are discussed in terms of potential cellular detoxification mechanisms, which are important in the cell's ability to cope with the anthropogenic introduction into the aquatic environment of metal and industrial pollutants. (Author's abstract)
W86-01405

IDENTIFICATION OF FERRITIN AS A MAJOR HIGH MOLECULAR WEIGHT ZINC-BINDING PROTEIN IN THE TROPICAL ROCK OYSTER, SACCOSTREA CUCCULLATA,
Murdoch Univ. (Western Australia). School of Mathematical and Physical Sciences.
J. Webb, D. J. Macey, and V. Talbot.
Archives of Environmental Contamination and Toxicology, Vol. 14, No. 4, p 403-407, July, 1985. 3 Fig, 1 Tab, 25 Ref.

Descriptors: *Ferritin, *Zinc, *Proteins, *Animal physiology, *Oyster, *Water pollution effects, *Dampier, *Western Australia, *Australia, Mollusks, Iron, Copper, Metals.

The metal-binding proteins of the body mass of the tropical rock oyster Saccostrea cucullata from the iron-ore shipping terminals near Dampier, Australia, have been separated by gel chraphy and analyzed for Zn, Fe, and Cu. A ble amounts of Zn (40%) and Cu (25% eluted in association with high molecula fraction (> 60,000 daltons), the major co of which was identified as the heat st binding protein, ferritin (approx, mol. wt. which also contains 95% of the Fe detecte tin thus accounts for significant amounts tein-bound Zn in this species and most pr other bivalves containing elevated tissue Zn. (Author's abstract)
W86-01406

MICROBIAL ASSAY FOR DETER THE INFLUENCE OF PHYSICOCH ENVIRONMENTAL FACTORS ON TH ICITY OF ORGANICS: PHENOL,
New York Univ., NY. Lab. of Microbial
H. Babich, and G. Stotzky.
Archives of Environmental Contamina Toxicology, Vol. 14, No. 4, p 409-415, Ju 8 Fig, 31 Ref.

Descriptors: *Toxicity, *Phenol, *Fung icochemical characteristics, Water poll fects, Hydrogen ion concentration, Harc linity, Water temperature, Synergistic eff ticides, Toxaphene, Cresols, Endrin aldeh

The toxicity of phenol to filamentous f unaffected by pH or water hardness, b potentiated by salinity at levels comp those occurring in estuarine and off-sho waters. The effect of temperature on the of the fungi to phenol was highly variable ing on the fungus, the toxicity of phenol not affected, increased, or decreased as th ature was raised from 22 to 32 C. The t phenol was not affected by heavy me mediating influences of these abiotic envi factors on the toxicity of phenol to fi fungi were similar to those reported fo macrobiota. This similarity, which has noted with the effects of environmental the toxicity of heavy metals, strengthen cept of using microbial assays to evalua the potential mediating influence of phy ical factors of natural environments on th of organic pollutants. An antagonistic i in toxicity occurred between phenol a aldehyde or p-chloro-m-cresol, and an interaction occurred between phenol phene, but no interactions were apparen phenol and other phenolic compounds cides. (Author's abstract)
W86-01407

COMPARATIVE ACUTE SENSITIVI EARLY LIFE STAGES OF AT FISHES TO CHLORPYRIFOS AND T CARB,
Environmental Research Lab., Gulf Br
P. W. Borthwick, J. M. Patrick, and D. F Middaugh.
Archives of Environmental Contamin Toxicology, Vol. 14, No. 4, p 465-473, 1 Fig, 6 Tab, 40 Ref.

Descriptors: *Grunion, *Silver-side, *Fis ity, *Chlorpyrifos, *Thiobencarb, *Or phorus pesticides, Pesticides, Insecticid pollution effects, Growth stages.

Sensitivity, expressed as the 96-hr LC from acute lethality tests, was compare ages (day-of-hatch, 7-day, and 28-day atherinid fishes: Leuresthes tenuis (Calif ion), Menidia menidia (Atlantic silver Menidia peninsulae (tidewater silver- sponses of each age-species combinatio to the organophosphate insecticide ch and the carbamate herbicide thioben compared in both static and flowing sea icity tests. Chlorpyrifos was highly t atherinids (96-hr LC50's ranged from micro-g/L); toxicity of thiobencarb w mately two orders of magnitude lov values from 199 to 1,405 micro-g/L). R

esticide were similar among the three spe-
ensitivity was generally highest for 7-day
-day age groups, and flowing water tests
nore sensitive measures of toxicity than
ests, especially for chlorpyrifos. Compari-
three computational methods indicate that
nd moving average methods calculate com-
LC50 estimates with the binomial method
ie least uniform point estimator. (Author's
)
408

OCHLORINE CHEMICAL RESIDUES
HITE PELICANS AND WESTERN
S FROM THE KLAMATH BASIN,
ORNIA,
ia Univ., Davis. Dept. of Wildlife and
Biology.
ellstorff, H. M. Ohlendorf, D. W.
n, E. J. O'Neill, and J. O. Keith.
of Environmental Contamination and
gy, Vol. 14, No. 4, p 485-493, July, 1985.
Tab, 39 Ref.

ors: *Pelicans, *Grebes, *Klamath Basin,
ake, *California, *Animal tissues, *Birds,
ated hydrocarbons, DDT, DDD, Diel-
lychlorinated biphenyls, Endrin, Pesti-
ecticides, Eggs, Wildlife habitats.

were analyzed for 12 organochlorine
. Concentrations of DDT + DDD and
in American white pelican (Pelecanus
ynchos) eggs collected at the Klamath
tional Wildlife Refuges decreased from
981; DDE and polychlorobiphenyl (PCB)
did not significantly change. Differences
PCB residues in eggs collected from
lamath and Clear Lake colonies in 1969
different migration routes or wintering
ween populations nesting at these two
White pelican and western grebe (Aech-
occidentalis) PCB/DDE ratios were
1.58, respectively, suggesting different
patterns. White pelican eggshell thickness
between 1969 and 1981, but remained
ly less than pre-1947 values. Western
l thickness was not significantly different
1947 values. Endrin caused some of the
rtalities in the Klamath Basin from 1975
Pelicans may have acquired endrin in
but possibly from areas outside of the
asin. (Author's abstract)
)

OF LETHAL COPPER SOLUTIONS
BEHAVIOR OF RAINBOW TROUT,
AIRDNERI,
Univ., Sir George Williams Campus,
(Quebec). Water Pollution Research

lder, and E. J. Maly.
of Environmental Contamination and
, Vol. 14, No. 4, p 501-507, July, 1985.
b, 18 Ref.

: *Copper, *Metals, *Trout, *Fish,
*Fish behavior, Behavior, Water pollu-
Fish food.

s were performed on flow-through arti-
n apparatus to determine the attraction-
responses of rainbow trout, Salmo
lethal copper solutions (0.5, 0.75, 1.0,
4.0 mg/L) when food was provided at
urce in the more contaminated water
food was provided throughout the
ference of groups of twenty test indi-
the experimental or control water was
hourly intervals over 96 hr. At all
ons, there was an initial attraction
nd subsequenct avoidance of the more
aminated waters. Attraction was great-
employing higher concentrations (3.0
/L); this attraction led to high mortali-
avoidance of copper solutions was ob-
levels above 0.5 mg/L maximizing at
The EC50-96-hr value for avoidance
n 0.5 and 0.75 mg/L. With food pro-
n contaminated water, fish exhibited a
and intense attraction period at the lower levels (0.5 to 2.0 mg/L) when compared to dispersed feeding. No significant differences between the feeding regimes existed at the higher copper levels. Mortality curves were similar in both feeding routines. Injured fish were found in the least contaminated waters. Tagging experiments indicate a movement pattern initially toward the toxicant, with subsequent reverse migration to cleaner waters. Little movement occurred during attraction and avoidance stages. Initial avoidance was not observed at any of the tested copper concentrations. Results indicate initial attraction at all concentrations may orientate fish toward the contaminant source, and subsequent avoidance behavior had little effect on survivorship rates. Observed trout behavior subsequent to copper discharges contributed to high mortality; behavioral response of organisms to toxicants must be incorporated into work attempting to set reasonable water-quality standards in natural water bodies. (Author's abstract)
W86-01410

SODIUM IN DRINKING WATER IN SOUTH CAROLINA,
South Carolina State Dept. of Health and Environmental Control, Columbia. Div. of Chronic Disease.
D. T. Lackland, M. C. Weinrich, F. C. Wheeler, and D. M. Shepard.
American Journal of Public Health, Vol. 75, No. 7, p 772-774, July, 1985. 2 Tab, 22 Ref. National Heart, Lung, and Blood Institute contract N01-HV-72987.

Descriptors: *Sodium, *Drinking water, *South Carolina, *Hypertension, Diet, Public health, Chemical composition, Calcium, Minerals, Blood pressure, Water quality.

Because of the reported variability between individuals in the percent of dietary sodium contributed by drinking water, the potential contribution of drinking water sodium to total consumption and to blood pressure levels was explored in a South Carolina population-based survey. The Carolina Health Survey was implemented in 1982 to obtain information on hypertension, health status, and health behaviors of non-institutionalized South Carolinians 18 age or older. For each of the 825 participating households, a 50 ml water sample was taken from the water source used for drinking and cooking purposes; sodium analysis was determined by the flame emission technique. Drinking water consumption was estimated at one liter per day. In the field, interviewers took blood pressure measurements from one adult in each household and administered a diet questionnaire. Most (96 per cent) of the population was served by drinking water containing $<$ 100 mg/l Na (median 14.8 mg/l). For households with water sources containing $>$ or $=$ 100 mg/l Na, drinking water accounted for approximately 8.5 per cent of total estimated consumption. After adjustment for age, sex, race, body mass index, education, and dietary sodium, a negative association between diastolic blood pressure and drinking water sodium levels was found. No significant associations of dietary sodium with either systolic or diastolic BP were found. The linear discriminant analysis to assess drinking water and dietary sodium as identifiers of hypertensives showed no contribution for dietary sodium, but a statistically significant contribution for drinking water sodium ($p<.05$). It is suggested that the observed negative association between systolic and diastolic BPs and drinking water sodium is not simply due to chance but the association is causally improbable; the observed association may result from confounding by other minerals such as calcium. (Collier-IVI)
W86-01411

SOLUBILZATION EFFECTS OF SIMULATED ACID RAIN ON THE ORGANIC MATTER OF FOREST SOIL; PRELIMINARY RESULTS,
Queen's Univ., Kingston (Ontario). Dept. of Chemistry.
G. W. Hay, J. H. James, and G. W. vanLoon.
Soil Science, Vol. 139, No. 5, p 422-430, May, 1985. 6 Fig, 3 Tab, 34 Ref. Canada Department of Supplies and Services contract ISU80-00350.

Descriptors: *Acid rain, *Water pollution effects, *Forest soils, *Organic matter, *Solubilization, Chemistry of precipitation, Acidity, Hydrogen ion concentration, Organic carbon, Nitrogen.

The concentrations of total organic carbon, total carbohydrate, fulvic acid, and ammonium-plus-amino nitrogen were determined in leachates from columns of a Canadian shield podzol soil at depths of approximately 10 and 20 cm after treatment with aqueous solutions of pH 5.7, 3.5, and 2.0. Sampling was carried out in the laboratory over a 16-d period during which the soil received a total accumulation of 935 mm of simulated rainfall, equivalent to 1 year's precipitation. Highest concentrations of each of total organic carbon, total carbohydrate, and fulvic acid were obtained after the pH 5.7 treatment; the concentrations were greater at the 10-cm depth than at 20 cm. The pH 2.0 solution dissolved the least amounts of these components. The opposite trend was observed in the analyses of ammonium-plus-amino nitrogen. The soil exhibited considerable buffering action in terms of regulating leachate pH. (Author's abstract)
W86-01421

UPTAKE AND RELEASE OF SOME TRACE METALS BY AQUATIC BRYOPHYTES IN ACIDIFIED WATERS IN SCOTLAND,
Freshwater Fisheries Lab., Pitlochry (Scotland).
For primary bibliographic entry see Field 7B.
W86-01452

EFFECTS OF AUTUMN APPLICATION OF OIL ON SPARTINA ALTERNIFLORA IN A TEXAS SALT MARSH,
Texas A and M Univ. at Galveston. Dept. of Marine Biology.
J. W. Webb, S. K. Alexander, and J. K. Winters.
Environmental Pollution (Series A), Vol. 38, No. 4, p 321-337, 1985. 1 Fig, 5 Tab, 35 Ref. State of Texas grant 18837.

Descriptors: *Water pollution effects, *Oil pollution, *Spartina, *Salt marches, *Texas, Marshes, Sediments, Aquatic plants, Plant growth, Biodegradation, Biomass.

Arabian crude oil, Libyan crude oil, No. 6 fuel oil and No. 2 fuel oil were applied, in November 1981, to 1 sq m salt marsh plots in Galveston Bay, Texas. Oil treatments were: no oil, 1 liter on sediment, 1.5 liters on sediment and lower 30 cm of Spartina alterniflora and 2 liters on sediment and entire S. alterniflora surfaces. All oils caused death of above-ground parts of plants within 3 weeks when applied to entire plant surfaces. Partial coverage was harmful only with No. 2 fuel oil, while sediment application had no effect. By 5 months, new growth had occurred from roots and rhizomes in Arabian crude oil, Libyan crude oil and No. 6 fuel oil plots and live biomass was near that of controls. By 1 year recovery was complete. For No. 2 fuel oil plots, which sustained the greatest mortality, growth was significantly below control levels at 5 months and 1 year, but recovery was complete within 2 years. Slow recovery in No. 2 fuel oil plots appeared to be due to the initial mortality of below-ground, as well as above-ground, plant parts. Toxicity of residual oil in the sediment did not appear to be a factor in slow recovery since seedling establishment had occurred within 5 months and little residue of No. 2 fuel oil was present in the sediments after 1 year. Also, this residue did not contain alkyl-substituted naphthalenes, toxic components present in the original oil. Considerable residues of all oils except No. 2 fuel oil were present in the sediment after 1 year. Pristane/nC17 and phytane/nC18 ratios indicated that removal of some oil components had occurred through biodegradation. (Author's abstract)
W86-01465

IMPACT OF LAND-APPLIED INCINERATOR ASH RESIDUE ON A FRESHWATER WETLAND PLANT COMMUNITY,
Massachusetts Univ., Waltham. Suburban Experiment Station.

J. S. Mika, K. A. Frost, W. A. Feder, and C. J. Puccia.
Environmental Pollution (Series A), Vol. 38, No. 4, p 339-360. 1985. 6 Fig, 3 Tab, 24 Ref.

Descriptors: *Ash, *Land disposal, *Wetlands, *Vegetation, Species abundance, Species diversity, Environmental effects, Phytotoxicity, Groundwater pollution, Landfills.

In 1977, 60-70 tons of incinerator ash residue were deposited adjacent to a freshwater wetland. These residues are known to contain elevated concentrations of soluble cations and toxic elements. The impact on the wetland plant community was monitored over a 6-year period. Changes in species abundance and diversity were assessed both over time and distance from the residue deposition. A methodology from the marine benthic pollution literature as used to identify possible indicator species from the group of moderately adapted plants. Distance from the residue did not account for the overall increase in community richness, but appeared to be a factor in the increased relative abundance of moderately adapted species near the residue site, as a result of decreased relative abundance of dominant species. Acute phytotoxic effects were undetected, with the possible exception of the decline of Asclepia syriaca (milkweed). Post-experiment soil analyses indicated an increase of Ca, Mn, P, Zn and Cd in wetlands soils near the residue site and an even greater increase in P, K, Ca, Mg, B, Zn, Cu, Mn, Al, Cd, and Pb in the soil directly beneath the residue. If residue landfills are not properly designed or maintained, the cumulative impact of daily residue deposition could eventually disrupt sensitive ecosystems and pollute adjacent soils and groundwater. (Author's abstract)
W86-01466

WATERBORNE EPIDEMIC OF ACUTE INFECTIOUS NON-BACTERIAL GASTROENTERITIS IN ALBERTA, CANADA,
903 Abbotsford Drive N.E., Calgary, Alberta T2A 5Y3.
A. E. O'Neil, D. Richen, and P. Lundrie.
Canadian Journal of Public Health, Vol. 76, p 199-203, June, 1985. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Epidemiology, *Public health, *Drinking water, *Gastroenteritis, *Alberta, Water treatment, Monitoring, Wastewater pollution, Water pollution effects, Water quality control.

In February 1983, an epidemic of gastroenteritis affecting approximately 3000 persons occurred in a city of 6500 in Alberta. The onset of 78% of the cases was within a four day period. Vomiting was a sympton in 52% of the cases and diarrhea in 60%. Duration of illness was 24 to 48 hours. Median incubation period was 38 hours. Stool cultures form affected persons were negative for bacterial pathogens. Search for a viral agent has so far been unrevealing. Illness was associated with consumption of water from the municipal system. The execution and monitoring of water treatment were faulty. The source of water in that system is a river whose pollution was augmented just before the epidemic by a discharge of raw sewage from a lift station of the municipal sewage collection system. A chain of causation in a gastrointestinal epidemic is illustrated, against which legislation for protection exists in the Clean Water Act. Those carrying out the treatment of the water and the protection of the river and even those charged under the Act with monitoring and enforcing these functions had a weak appreciation of their significance to Public Health. (Author's abstract)
W86-01486

LIMITATIONS OF PHOSPHORUS WATER QUALITY CRITERIA,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
For primary bibliographic entry see Field 5G.
W86-01492

EFFECT OF SUSPENDED SOLIDS ON THE GROWTH OF APICAL TIPS OF GAMETOPHYTE PLANTS OF LEMANEA AND ON CARPOSPORE GERMINATION AND SUBSEQUENT COLONISATION,
University Coll., Cardiff (Wales). Dept. of Plant Science.
H. H. Thirb, and K. Benson-Evans.
Archiv fur Hydrobiologia, Vol. 103, No. 4, p 401-417, June, 1985. 3 Tab, 18 Ref.

Descriptors: *Suspended solids, *Plant growth, Light penetration, Water pollution effects, Plant reproduction.

Lemanea was exposed to a range of concentrations of suspended solids and settled material covering the substrate. Coal dust was used as a source of suspended solids. In addition to the laboratory experiments, a field experiment involving the transplant of mature plants of Lemanea from a site with low suspended solids and little pollution to a site downstream where the suspended solids were high. Reduction in light intensity from turbid conditions of suspended solids (5,000 mg/l) reduced primary production in both the chantransia-stage and adult plants. The deposition of a thick layer of silt prevented fixation and colonization of the substrate by carpospores. (Baker-IVI)
W86-01498

EFFECTS OF A CRUDE OIL SPILL ON WATER QUALITY AND MACROBENTHOS OF A SOUTHEAST TEXAS STREAM,
Lamar Univ., Beaumont, TX. Dept. of Biology.
R. C. Harrel.
Hydrobiologia, Vol. 124, No. 3, p 223-228, May, 1985. 1 Fig, 2 Tab, 23 Ref.

Descriptors: *Oil spills, *Water pollution effects, *Stream pollution, *Benthos, *Texas, Water quality, Oil pollution, Dissolved oxygen, Carbon dioxide, Invertebrates, Species diversity, Oligochaetes, Midges, Streamflow, Water temperature.

On December 6, 1981 a crude oil spill of 160 barrels (25,440 liters) occurred in a small southeast Texas stream. On December 8 a boom was placed across the mouth of the stream, and organized cleanup began December 12. During the cleanup, some oil was manually pushed down into the steam sediments. Water quality changes, other than the presence of oil, were not evident until six months later when water temperature increased and stream flow ceased. A thick film of oil and plant detritus covered the surface of the stream. This resulted in decreased dissolved oxygen and increased carbon dioxide concentrations. Responses of the benthic macroinvertebrate community included an increase in density of oligochaetes, decrease in numbers and taxa of chironomids, with eventual complete elimination, and low community diversity. Decrease in oil concentration resulted in reversal of these responses. Eleven months after the spill, stream flow had resumed and water temperature decrease, but oxygen concentrations remained low. No clean water taxa were collected and complete recovery had not occurred 26 months after the spill when the study was terminated. All taxa were tolerant or facultative to organic pollution. (Moore-IVI)
W86-01506

MONITORING AND EVALUATION OF WATER POLLUTION IN TUMEN RIVER BY MEANS OF ALGAE (IN CHINESE),
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
Z. Zhand, Z. Mo, K. Rong, and H. Haoming.
Acta Hydrobiologica Sinica, Vol. 8, No. 1, November, 1983. 2 Fig, 7 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Algae, *Monitoring, *Tumen River, Scenedesmus, Bioassay, Industrial wastewater, Bioindicators, Periphyton, Photosynthesis.

Studies on attached algae communities, collected from artificial substrates, were made in upper and middle reaches of Tumen River in 1977-1979. Bioassay using Scenedesmus for some effluents was carried out in laboratory. Based on results obtained, an evaluation of water pollution in the River was made. The upper reach, represented by station Chongshan, is evaluated as an unpolluted area. The middle reach, from the drainage o ore mining effluents downwards to station grenping, is a heavily to moderately pollute From station Caidui, where the River recei pulp mill effluent, to city Tumen, the river w most heavily polluted. The stretch of Riv tween station Hedung and the pollution sou brown-coal chemical industry in the lower r considered as slightly to moderately pollute assay test also show that pulp mill effluent is the main pollution sources of River Tume acute ILm of Scenedesmus to the main effluent of the pulp mill is about 45% (v/v most toxic is the sulfite waste liquor. The h effect on algae growth by iron-ore mining o is caused by the large amount of suspended contained in this effluent, which reduces ph thetic activity of algae. This effluent must b sidered as another main pollution source river. Discussing and comparing the results phyton studies in Tumen River, the autho pose some algological indices for monitori evaluating pollution conditions in this Among them the total count of attached a the most suitable and is expressed as a com relative value. Some indicator algae spec presented. The application of diversity ind discussed. (Author's abstract)
W86-01512

SPY POND DIAGNOSTIC-FEASIB STUDY: RECOMMENDATIONS FOR RE ING A LAKE IMPACTED BY URBAN ST WATER RUNOFF,
Massachusetts Dept. of Environmental Qual gineering, Westborough. Div. of Water Po Control.
For primary bibliographic entry see Field 2E
W86-01550

SIX PONDS DIOXIN SURVEY,
Massachusetts Dept. of Environmental Qual gineering, Westborough. Div. of Water Po Control.
J. J. Jonasch.
Northeastern Environmental Science, Vol. 2, p 80-89, 1984. 3 Fig, 9 Tab, 8 Ref.

Descriptors: *Dioxins, *Massachusetts, Winthrop, *Boons Pond, *North Pond, *No Pond, *Middlesex County, *Flint Pond, *W ter County, *Stockbridge Bowl, *Lake keenac, *Berkshire County, *Chlorinated carbons, *Fish tissues, Animal tissues, Bu Herbicides, Water pollution effects, Fate of ants.

The objective of this study was to det through a screening survey whether 2,3 trachlorodibenzo-p-dioxin (TCDD) was pre six Massachusetts water bodies that have h of treatments with herbicides (Silvex, Ku 2,4,5-T) that contain 2,3,7,8-TCDD as a co nant formed during the manufacturing p The water bodies studied were Lake Wi Boons Pond, North Pond, and Nonesuch (Middlesex County), Flint Pond (Wo County), and Stockbridge Bowl (Lake Mahk (Berkshire County). Five of the six sedimen ples analyzed did not meet the analytic crite positive identification of the dioxin. De limits ranged from 3.0 ppt to 5.5 ppt. Lak throp did meet the criteria for positive ide tion and the sediment had a 2,3,7,8-TCDD c tration of 5.9 ppt. The survey confirmed th ence of 2,3,7,8-TCDD in one pond with a se sample containing 5.9 ppt 2,3,7,8-TCDD an sample (bullhead - Ictalurus sp.) containing of 2,3,7,8-TCDD. Age analysis suggests t fish have had at least 2.5 years of exposure respective lakes with a study-wide average years. Lake Winthrop appears to have been very little over the years compared to the lakes studied. The fish flesh concentration e the U.S. Food and Drug Administration gu of 50 ppt in fish flesh for human consumptio five archived bullheads from Lake Winthro retested and nets were set in the lake to c more specimens. Yellow perch and pickere mens had no detectable levels of 2,3,7,8-

one of the bullheads had a detectable level of -TCDD; in two tests the concentration was ined to be 19 and 25 ppt. The high detection in the other samples present a problem since -TCDD could possibly be present below imits. (Collier-IVI)
1551

RONMENTAL IMPACT ASSESSMENT E PCB PROBLEM: A REVIEW,
l Univ., Ithaca, NY. Ecosystems Research

mary bibliographic entry see Field 5B.
1553

ON RIVER PCB RELATIONSHIPS BE-N RESIDENT FISH, WATER AND SEDI-

ork State Dept. of Environmental Conser-Albany.
n, M. Brown, and R. Brandt.
astern Environmental Science, Vol. 3, No. 37-151. 18 Fig, 7 Tab, 37 Ref.

tors: *Polychlorinated biphenyls, *Hudson *New York, *Fish, *Sediment, *Fate of nts, Monitoring, Chlorinated hydrocarbons, ollution effects, Pumpkinseed, Fish tissues, ne environment.

, long term monitoring of PCB levels in environmental strata in the Hudson River tiated. Among the variety of fish species ve been monitored, fall-caught yearling nseed (Lepomis gibbonsus) were selected as rdized tool for monitoring trends in the ntamination of the river's biota. This phase toring was implemented in 1979, two years sation of the major PCB discharges at Ft. and Hudson Falls. The high degree of ion between waterborne and yearling nseed PCB concentrations demonstrated time for a region of the upper Hudson that pumpkinseed are a sensitive indicator of vironmental contamination. A decline in ncentrations in both water and fish was throughout the river through 1980. An 80-od during spring 1983 apparently did not the availability of PCB to the biota in the ver. In the lower river, the bioavailability appeared to increase in the Newburgh area ted by an increase in the mean PCB con-n in the yearling pumpkinseed. The mean ncentration in pumpkinseed collected at nd Stillwater did not change significantly. servations are consistent with a working is of how the hydrology and transport of the upper and lower river mediate the ental exposure of the biota to PCB. Com-among other adult spring sampled species r age classes of the pumpkinseed through w that although increases were not uni-her was there evidence of continued de-upled with relatively high sediment con-ns, it appears that this system has reached able state with respect to PCB levels in (Author's abstract)
54

DIETARY DOSE AND BURDENS IN BASS FROM THE HUDSON RIVER,
rk Univ. Medical Center, Tuxedo Park. nvironmental Studies.
'onnor.
ern Environmental Science, Vol. 3, No 52-158. 4 Tab, 30 Ref. NIEHS grant

rs: *Polychlorinated biphenyls, *Bass, ues, *Hudson River, *New York, *Water effects, Fish diets, Chlorinated hydrocar-nmarus, Amphipods.

orting the hypothesis that polychlorinat-yl (PCB) body burdens in fish are related ly dietary dose, as modified by the meta-esses of assimilation, tissue retention and n have been based exclusively on labora-es. As a field verification of this hypothe-s of striped bass, and their stomach con-tents, were analyzed for PCBs in order to determine relationships between PCB concentration in the food and PCB burdens in the fish. Samples of striped bass were collected from the New York Harbor region (the Hudson River at Weehawken, NJ (WHK) and between piers at Canal Street in Manhattan, NY (CST)) during the winter of 1983. The majority of food organisms observed in striped bass stomachs were benthic and epibenthic crustacea, primarily Gammaridean amphipods. Total body burden of PCB in young striped bass was calculated as the concentration of PCB in the flesh times the dry-weight of the specimen with the dry-weight concentration in the flesh assumed to be the same as the dry-weight concentration in most of the tissues and organs. Due to the greater concentration of PCB in striped bass from CST, PCB burdens (mean = 67.6 micro-g total PCB) were greater than in the bass from WHK (mean = 25.7 micro-g). Stomach contents from striped bass taken at WHK contained a mean of 2.3 micro-g/g total PCB, while the PCB concentrations of stomach contents from fish taken at CST were 6.15 micro-g/g. At the CST station, PCB concentrations in the food were greater than in the flesh of the fish. At the WHK station the PCB concentrations in the food and in the fish were similar. The ratio of mean PCB concentrations in stomach contents to that of the flesh was similar at the two stations (0.70 at WHK and 0.71 at CST). The results provide paired dose/burden data useful in refining mathematical models for predicting the accumulation of PCB and other xenobiotics in fish, based upon empirical data rather than rough estimates of exposure parameters. (Collier-IVI)
W86-01555

ORIGIN OF HIGH CADMIUM CONCENTRATIONS IN HUDSON RIVER BLUE CRAB (CALLINECTES SAPIDUS RATHBUN),
New York State Dept. of Environmental Conservation, Albany. Bureau of Environmental Protection.
R. Sloan, and R. Karcher.
Northeastern Environmental Science, Vol. 3, No. 3/4, p 221-231. 4 Fig, 4 Tab, 37 Ref.

Descriptors: *Cadmium, *Animal tissues, *Crab, *New York, *Hudson River, *Flushing Bay, *Long Island Sound, Heavy metals, Metals, Water pollution effects, Source of pollutants, Mercury, Public health.

In 1979, due to high cadmium concentrations in blue crab, Callinectes sapidus, the New York State Health Department warned against consuming the hepatopancreas and to restrict leg meat consumption to one meal per week, based on a limited Hudson River summer sampling. A lack of data from other localities led to collections in 1981 from 11 locations in New York marine waters, including 6 Hudson river, 1 Staten Island and 4 Long Island sites. Muscle and hepatopancreas tissues were analyzed for cadmium utilizing atomic absorption spectrophotometric techniques. Although female sample sizes were small in areas of high contamination, they tended to have greater cadmium concentrations than males by factors of 1.5 to 2. Regardless of sex, the six Hudson River locations produced average concentrations of 0.24 ppm (N = 55) and 7.86 ppm (N = 60) for the leg muscle and hepatopancreas, respectively, compared to average values for similar tissues from other areas (excluding Flushing Bay) of 0.09 ppm (N = 25) and 0.72 ppm (N = 25). Cadmium concentrations were two to five times higher in thoracic muscle than leg muscle (N = 8). Flushing Bay crabs had higher hepatopancreas levels (-x = 3.84 ppm; N = 8) than other Long Island crabs indicating a potential cadmium source. Overall, the bulk of cadmium contamination appears to originate in the Hudson River. Limited numbers of mercury analyses reflected relatively low concentrations with respect to the USFDA action level of 1 ppm. Lobsters (Homarus americanus) from western Long Island Sound were suprisingly high in cadmium, and the few analyzed (N = 10) indicate a need for additional study of this species. (Author's abstract)
W86-01565

SURVIVAL STRATEGIES OF INVERTEBRATES IN DISTURBED AQUATIC HABITATS,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-01581

RESPONSE OF INVERTEBRATES IN TEMPORARY VERNAL WETLANDS TO ALTOSID SR-10 AS USED IN MOSQUITO ABATEMENT PROGRAMS,
Minnesota Dept. of Natural Resources, St. Paul.
R. W. Lawrenz.
Journal of the Minnesota Academy of Science, Vol. 50, No. 3, p 31-34, 1984/85. 2 Fig, 5 Ref.

Descriptors: *Mosquitos, *Invertebrates, *Wetlands, *Insecticides, *Ecological effects, Water pollution effects, Pesticides, Toxicity, Hormones.

Three temporary vernal wetlands on the Bayport Wildlife Management Area in eastern Washington County, Minnesota, were divided by sandbag barrier into treatment and control areas. Designated areas were treated with Altosid SR-10 briquets at standard mosquito control rates. Invertebrate populations were monitored weekly using net sweeps, column samples, and ocular estimates. The development of Eubranchipus bundyi, Lyncerus sp, and Daphnia sp., the three major components of the invertebrate fauna, was delayed by as much as one week in site 47. Similar development lags were noted for E. bundyi populations in the treated portions of sites 6 and 32. Delay of maturation was expressed in greater longevity and higher male to female sex ratios for treated populations of E. bundyi. Daphnia sp. population growth was also retarded by treatment, with a concurrent lag in ephippium (resting egg) formation. Delay in the development or sexual maturity of vernal faunas could impact those faunas and the wildlife that are dependent on them as seasonal dietary protein resources. (Author's abstract)
W86-01582

IDENTIFYING POLLUTION RELATED CHANGES IN CHIRONOMID COMMUNITIES AS A FUNCTION OF TAXONOMIC RANK,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. C. Waterhouse, and M. P. Farrell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 406-413, March, 1985. 2 Fig, 3 Tab, 21 Ref. EPA grant R805193-02-2 and DOE contract DE-AC05-840R21400.

Descriptors: *Water pollution effects, *Midges, *Taxonomy, Heavy metals, Metals, Zinc, Copper, Chromium, Invertebrates, Presence/absence data, Ecological effects.

Specific- and generic-level analyses of chironomid presence/absence data were compared along a heavy-metal gradient. Eighteen binary similarity coefficients were calculated for five sampling stations from a small Ohio stream that receives an effluent containing zinc, copper, and chromium from a metal-plating industry. In general, the specific- and generic-level values were highly correlated and showed similar patterns across the 10 station comparisons. The basis for this correlation was then investigated by an assessment of both the amount (average number of species per genus) and the pattern (species to genus ratio trend) of information loss along the pollution gradient. Trends in the species to genus ratio along the gradient are viewed as indicative of the similarity of congenerics in their response to the gradient. The lack of a significant trend in the species to genus ratio in our data indicates that the agreement between specific- and generic-level analyses was due to the ability of a robust species distribution pattern to withstand a limited amount of random information loss, rather than any inherent similarity among congenerics reflected in their species to genus ratio trends. Analyses based on only a few species (e.g. abundant or indicator species) cannot afford as much information loss and must rely more heavily on similarity of congeneric species. (Author's abstract)

W86-01583

DISCRIMINATION OF THE STOCK OF FISH (EELS, ANGUILLA ROSTRATA) BASED ON THE PRESENCE OF THE SYNTHETIC CHEMICAL MIREX (DISCRIMINATION D'UN STOCK DE POISSON, L'ANGUILLE (ANGUILLA ROSTRATA), BASEE SUR LA PRESENCE D'UN PRODUIT CHIMIQUE DE SYNTHESE, LE MIREX),
Department of Fisheries and Oceans, Quebec. Fisheries Research Branch.
J. D. Dutil, B. Legare, and C. Desjardins.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 3, p 455-458, March, 1985. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Bioindicators, *Fisheries, *Eels, *Saint Lawrence River, *Ontario, *Quebec, *Lake Ontario, *Mirex, Pesticides, Chlorinated hydrocarbons, Path of pollutants, Water pollution effects, Fish, Water quality.

Mirex concentrations were measured in eels (Anguilla rostrata) from eastern Canada to determine the contribution of Lake Ontario eels to the Saint Lawrence commercial fishery. Mirex could be detected in all eels (50 specimens) collected in Lake Ontario (0.18 + or - 0.11 micro-g/g). Most sedentary eels collected from the Saint Lawrence commercial fishery and both the migratory and sedentary eels collected from the Saint Lawrence tributaries and the Maritimes had no mirex. Of the migrating eels collected in the Saint Lawrence 74% contained mirex (0.17 + or - 0.19 micro-g/g). These results show that stocks can be discriminated on the basis of the presence of synthetic chemical products such as pesticides and other contaminants that are distributed heterogeneously in the environment. Based on a presence-absence criterion, this method for stock discrimination has the distinct advantage that it is more accurate and less time consuming than similar methods based on the presence of natural chemical products. (Author's abstract)
W86-01584

WINTER RESPIRATION OF LAKES AT SAQVAQJUAC, N.W.T.,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W86-01587

RESULTS OF OHIO RIVER MACROINVERTEBRATE SAMPLING FOR 1975-1981,
West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources.
J. E. Fisher, and L. E. McCoy.
Proceedings of the West Virginia Academy of Sciences, Vol. 55, No. 2/3/4, p 42-55, 1983. 9 Fig, 7 Ref.

Descriptors: *Ohio River, *Macroinvertebrates, *Species diversity, *Rivers, Water pollution effects, Species composition.

The results of macroinvertebrate sampling from nine stations along the Ohio River are presented. Comparisons of Brillouin diversity, numbers of individuals, and taxa present for each site indicated significant improvements in the biological communities for two sites, Weirton and Hannibal. Only one site, Keyger Creek, was significantly poorer over time. Most other stations appeared to have made some improvement or remained unchanged, with the notable exceptions, however, of Willow Island and Belleville. These stations appeared to have been adversely impacted by some factor or combination of factors. The Belleville site had shown continued improvement from 1975 through 1980. However, the 1981 sample revealed a significant drop in diversity. (Author's abstract)
W86-01591

ASSOCIATIONS OF CANCER MORTALITY RATES AND EXOGENOUS ENVIRONMENTAL FACTORS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Anatomy.
P. Baciu, E. C. Keller, and J. D. Tucker.
Proceedings of the West Virginia Academy of Science, Vol. 55, No. 2/3/4, p 82-91, 1983. 4 Tab, 6 Ref.

Descriptors: *Cancer, *West Virginia, *Water pollution effects, *Public health, Epidemiology, Alkalinity, Acidity, Zinc, Dissolved oxygen, Phosphate, Manganese, Water quality.

Correlation analyses were completed on West Virginia county data for cancer mortality rates and on county geological, water quality, and coal production variables. The individual cancer mortality variables most frequently observed to be in association with environmental variables were: mouth, pancreas, and rectal cancers in males, and nasal, lip, and stomach cancers in females. The environmental variables most frequently associated with these cancer were: (1) levels of alkalinity, water flow, acidity, zinc, dissolved oxygen, phosphate, and manganese found in the natural waters of the various counties; (2) levels of particulates, hydrocarbons, and nitrous oxides in the air; (3) the percentage of the county underlain by brine, medium bituminous coals, and three types of limestones; and (4) to a minor degree, the number of sand quarries in the county. An 'acid mine drainage' environmental factor as defined by factor analysis was highly associated with two cancer mortality groupings viz., 'male digestive' and 'female upper digestive' cancers. Two other water factors 'alkalinity' and 'zinc' were also strongly associated with the 'male digestive' cancer factor. The environmental factors are likely to be, at least in part, surrogates for other populational or occupational aspects of the demography such as urban-industrialized and rural-coal-producing areas. (Author's abstract)
W86-01593

CORBICULA FLUMINEA (MOLLUSCA: PELECYPODA) AS A BIOLOGICAL INDICATOR OF HEAVY METALS IN THE KANAWHA RIVER, WV,
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
For primary bibliographic entry see Field 7A.
W86-01596

LOW PH TOLERANCE UNDER CONTINUOUS-FLOW BIOASSAY CONDITIONS OF HELLGRAMMITE LARVAE, CORYDALUS CORNUTUS L. (MEGALOPTERA: CORYDALIDAE),
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
D. C. Tarter, L. O. Hartsock, S. I. McBride, and M. F. Sheridan.
Proceedings of the West Virginia Academy of Science, Vol. 55, No. 2/3/4, p 131-135, 1983. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Acidity, *Hydrogen ion concentration, *Toxicity, *Helgrammites, *Corydalidae, *Macroinvertebrates, *Bioassays, Water pollution effects, Acid mine drainage, Aquatic insects, Larvae.

Bituminous coal mining produces an acid drainage effluent that is generally recognized as the most widespread pollution problem in the Ohio River Basin. Hellgrammite larvae, Corydalus cornutus L., were experimentally tested under continuous-flow bioassay conditions to determine their tolerance to low pH. The straight-line graphical interpolation method was employed to determine the pH value at which 50 percent of the hellgrammites survived after 96 hours. The 96 hr median tolerance limit pH value was 1.76. Based on the hellgrammite larval continous-flow bioassay experiments and other laboratory and field studies of aquatic insects, the order Megaloptera can be considered the group of aquatic insects most tolerant to low pH conditions. The toxic mode of action of acid mine drainage on benthic macroinvertebrates has received some attention in the literature. Several mechanisms may be involved in the toxic mode of action of acid mine water on aquatic insect larvae. Apparently, larval megalopterans are able to survive in higher concentrations of mine drainage than most aquatic insects becau some well-adapted physiological response to extreme environmental conditions. (Collier-IV
W86-01597

EFFECT OF TEMPERATURE ON GROWTH OF PLANKTONIC LARVAE TELLINA TENUIS DA COSTA,
Dunstaffnage Marine Research Lab., Oban (land).
P. R. O. Barnet.
Journal of Experimental Marine Biology and ogy, Vol. 89, No. 1, p 1-10, June, 1985. 4 F Ref.

Descriptors: *Kames Bay, *Firth of Clyde, * land, *Tellina, *Bivalves, *Water temper *Growth rates, Water pollution effects, G stages, Molluscks.

Tellina tenuis da Costa has wide distribution intertidal sandy shores of Europe and is the monest intertidal lamellibranch on most sandy shores in the Firth of Clyde, Sco where large annual variations in spatfall known to occur. The effects of temperatu Tellina populations in Kames Bay were exam continuing earlier research, for comparison the influences of heated effluents from the H ston electricity generating stations at Ay The growth in length of planktonic veliger was examined experimentally at 7, 10, 15, a C. There were very pronounced differenc tween the lengths at different temperatures experiments commenced four days after fe tion with straight-hinge larvae of mean leng micro-m. Three days later t-tests showed that were highly significant differences betwee mean lengths of larvae grown at 7, 10, 15, a degrees C (104, 107, 111, 115 micro-m, respe ly). There were large differences betwee lengths at the end of the experiment, 32 days fertilization; 20 C larvae reached a mean micro-m compared with 196 micro-m at 15 C micro-m at 10 C, and only 117 micro-m at 7 C greatest increase in growth rate was betwe and 15 C; this is the range within which Jul water temperatures, when large numbers of are expected to be in the plankton, vary be warm and cool years. Sea-water temperatu the Firth of Clyde probably never reach a permitting optimum growth; higher July sea-temperatures in some years may encourage rapid larval growth than in cooler years. would shorten the pelagic larval phase, pro decreasing the vulnerability to predation plankton and permitting better survival to th tlement phase and may partly account for the annual variability in spatfalls of T. tenuis in Bay. (Collier-IVI)
W86-01603

BENTHIC ORGANISMS AS INDICATOR WATER QUALITY IN LAKE PATZCU MEXICO,
Universidad Nacional Autonoma de M Mexico City. Dept. de Quimica de la Atmos Estudios del Agua.
For primary bibliographic entry see Field 5A
W86-01608

INVESTIGATION INTO THE OCCURR OF SEWAGE FUNGUS IN RIVERS CONT ING PAPERMILL EFFLUENTS - I; RE OF PREVIOUS RESEARCH,
Pira, Leatherhead (England). Paper and Div.
L. J. Webb.
Water Research, Vol. 19, No. 8, p 947-954, Tab, 22 Ref.

Descriptors: *Pulp wastes, *Wastewater poll *Microorganisms, *Reviews, Pulp and pap dustry, Water pollution effects, Biol wastewater treatment, Sugars, Fatty acids, hols.

erm 'sewage fungus' denotes the variable unity of microorganisms which form volumi- cottonwool-like growths on river beds suitable physical characteristics. A brief is given of the published literature on e fungus growth from pulp and paper mill rges up to 1978. Previously unpublished ndertaken over the period 1965-1975 is de- . By 1978, it seemed clear that sewage from pulp and paper industry effluents was by the presence of low molecular weight s, a mixture of sugars, volatile fatty acids ohols in the case of pulping wastewaters arch-derived sugars in paper/board mill aters. Intermittent discharge was a proven ue for controlling sewage fungus growth ulp mill effluents. While biological treat- f papermill discharges could achieve high emoval, the inherent variability in the per- e of biological plants precluded the com- imination of sewage fungus growth poten- en the dilution available was only of the f 10- to 20-fold. (Moore-IVI)
635

TIGATION INTO THE OCCURRENCE WAGE FUNGUS IN RIVERS CONTAIN- APERMILL EFFLUENTS - II; CHEMI- NALYSIS OF MILL EFFLUENTS,
eatherhead (England). Paper and Board

bb.
esearch, Vol. 19, No. 8, p 955-959, 1985. 4 ef.

ors: *Pulp wastes, *Effluents, *Chemical tion, *Wastewater pollution, Dissolved Organic matter, Carbohydrates, Glucose, Melamine, Sugars, Nutrients.

ing and analytical program was carried out U.K. paper and board mills, the objective was to characterize the dissolved organic final effluents and component wastewater The analyses conducted were dissolved carbon (DOC), carbohydrate, glucose, melamine, hydrolyzed sugars and molecu- ht distribution. For 2 mills using virgin lp and waste-paper, carbohydrates (princi- ucans) are the major dissolved organic nt (70-80% DOC). The concentrations of ecular weight oligosaccharides and glu- both mills could be very significant in sewage fungus growth in the receiving pending on the dilution available. At a with on-site chemical pulping of rags, rate was less dominant in the mixed efflu- h contained a high proportion (70%) of unidentified organics. While the likely for sewage fungus growth at the third hus less definite, the identified organics drate plus gelatin) are more degraded organics at other mills. This factor com- h the low effluent dilution available may te for the lower nutrient concentrations. VI)
6

GATION INTO THE OCCURRENCE AGE FUNGUS IN RIVERS CONTAIN- ERMILL EFFLUENTS - IV; GROWTH ERIMENTAL CHANNELS DOSED FLUENTS AND PURE COMPOUNDS,
therhead (England). Paper and Board

b.
earch, Vol. 19, No. 8, p 969-974, 1985. 2 .

rs: *Wastewater pollution, *Pulp and stry, *Microorganisms, Water pollution lp wastes, Carbohydrates, Effluents, Nu- ucose, Starch, Gelatin, Resins, Organic s.

e fourth and final paper in a series of scribing research undertaken at PIRA 8-1980 on the causes and prevention of ngus growth in rivers receiving paper mill effluents. This paper describes simu- am studies in which sewage fungus growths from mixed mill effluents, component effluent streams and mill raw materials were quantified at two paper-mill sites. At the first mill, sewage fungus growth from treated effluent was only light and somewhat less than might have been expected from the measured level of glucose. Cationic starch was a better nutrient than unmodified starch and possible reasons for this are put forward. Individual waste streams at the second mill supported heavy growths of sewage fungus comparable to that from the mixed mill effluent after clarification. As sole sources of organic carbon, fresh or degraded gelatin and melamine formaldehyde resin gave very little sewage fungus growth, but glycerol supported some growth. As the effluent from this mill was considerably more complex than others previously examined, it was concluded that sewage fungus nutrients were provided by degraded organics (largely unidentified) extracted from rags and broke. (Author's abstract)
W86-01638

EVALUATION OF MATHEMATICAL MODELS FOR THE EFFECTS OF PH AND TEMPERATURE ON AMMONIA TOXICITY TO AQUATIC ORGANISMS,
College of Saint Scholastica, Duluth, MN. Dept. of Chemistry.
R. J. Erickson.
Water Research, Vol. 19, No. 8, p 1047-1058, 1985. 2 Fig, 4 Tab, 31 Ref.

Descriptors: *Mathematical models, *Hydrogen ion concentration, *Temperature, *Ammonia, *Toxicity, Aquatic animals, Gills, Fish.

Available data on the pH and temperature dependence of ammonia toxicity to aquatic organisms were examined and their agreement with various models was evaluated. A model which considers alteration of the relative concentration of un-ionized ammonia at the gill surface failed to adequately describe either pH or temperature dependence. A model that assumes that un-ionized ammonia and ammonium ion are jointly toxic was strongly supported by the data on pH dependence, but could not explain observed temperature dependence. Temperature dependence can be described empirically by a simple log-linear model. The effects of pH and temperature were generally found to be qualitatively and quantitatively similar among fish species. (Author's abstract)
W86-01648

ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SEDIMENT AND FISH FROM WETLANDS IN THE NORTH CENTRAL UNITED STATES,
Columbia National Fisheries Research Lab., Yankton, SD. Field Research Station.
D. B. Martin, and W. A. Hartman.
Journal of the Association of Official Analytical Chemists, Vol. 68, No. 4, p 712-717, July/August, 1985. 1 Fig, 5 Tab, 17 Ref.

Descriptors: *Pesticides, *Chlorinated hydrocarbons, *Polychlorinated biphenyls, *Wetlands, *Sediment contamination, *Fish, Pesticide residues, DDD, DDT, Dieldrin, BHC, Trans-nonachlor, DDE.

Sediments samples collected in 1980-1982 from riverine and pothole wetlands at 17 locations in the north central United States were analyzed for organochlorine pesticides, certain of their metabolites, and polychlorinated biphenyls (PCBs). Concentrations were above minimum detection levels (5 ng/g of organochlorines and 20 ng/g of PCBs) in less than 4% of the samples taken. Fish samples taken at 9 of these 17 locations, and analyzed for the same compounds, showed a higher frequency of detectable contaminants. The most common compound found in fish was DDE, which was found in 51% of the samples at levels up to 512 ng/g. Alpha-BHC was present at concentrations of 5 to 27 ng/g in 36% of the fish samples, and DDD was found at levels of 5 to 60 ng/g in 14%. Four other compounds, DDT dieldrin, PCB, and trans-nonachlor, were detected in fish at relatively low concentrations in less than 10% of the samples. This survey, thus, indicated little contamination by organochlorine pesticides or PCBs in the wetland habitats of this region. (Author's abstract)
W86-01651

ALUMINUM MOBILIZATION IN AN ACIDIC HEADWATER STREAM: TEMPORAL VARIATION AND MINERAL DISSOLUTION DISEQUILIBRIA,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
R. P. Hooper, and C. A. Shoemaker.
Science, Vol. 229, No. 4712, p 463-465, August, 1985. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Aluminum, *Water pollution effects, *Acid rain, *Acidity, *Streams, *Hubbard Brook Experimental Forest, *New Hampshire, Geochemistry, Metals, Hydrogen ion concentration, Seasonal variation, Snowmelt.

As part of an integrated field and modeling study an extensive sampling effort was undertaken on an instrumented watershed at the Hubbard Brook Experimental Forest (New Hampshire) to examine the chemical response of a stream to snowmelt and storm events during the spring of 1984. Intensive sampling was performed along an elevational gradient in the headwater stream to observe the chemical response of the stream to acidic inputs. Aluminum concentrations during this period were not in equilibrium with a readily formed mineral phase, as has been assumed, and the increase in aluminum concentration due to episodic depressions in pH lessened during the snowmelt. The temporal variation in the aluminum response to pH depressions indicates a more complicated aluminum mobilization mechanism than a mineral dissolution equilibrium. This temporal variation may be caused by the depletion of a slowly forming, labile pool of aluminum in the soil. The high aluminum concentrations may be influenced by a kinetic constraint in the precipitation of an aluminum mineral. Since the sampling focused on high flow events, the higher aluminum concentrations at the higher pH's found downstream could have been due to transport of aluminum that did not have time to precipitate out of solution. The observed disequilibrium between aluminum concentrations in stream water and a readily formed Al(OH)3 mineral phase reduce confidence in predictions of short-term temporal changes in stream chemistry made by investigators using models based on an equilibrium. The temporal pattern of the snowmelt is important in the mobilization of aluminum. The highest aluminum concentrations were observed in the mid-winter thaw, not during the main spring melt. Because sensitive life stages of fish species are present only at certain times of the year, such patterns are important in the assessment of the biological impacts of acid precipitation. (Collier-IVI)
W86-01678

BEHAVIORAL MODIFICATION OF ESTUARINE FISH EXPOSED TO SULFUR DIOXIDE,
Johns Hopkins Univ., Shady Side, MD. Aquatic Ecology Section.
L. W. Hall, D. T. Burton, W. C. Graves, and S. L. Margrey.
Journal of Toxicology and Environmental Health, Vol. 13, No 4-6, p 969-978, 1984. 2 Fig, 3 Tab, 24 Ref.

Descriptors: *Animal behavior, *Sulfur dioxide, *Fish behavior, *Water pollution effects, *Sulfites, Bass, Menhaden, Water temperature, Avoidance response, Model studies.

This study was designed to determine the avoidance responses of juvenile striped bass (Morone saxatilis) and Atlantic menhaden (Brevoortia tyrannus) exposed to sulfur dioxide (sulfite) at acclimation temperatures of 15, 20, 25, and 30 C. Predictive models were developed and compared for each species at each acclimation temperature. Striped bass avoided 2.2, 2.3, 3.0, and 3.5 mg sulfite/l at 15, 20, 25, and 30 C, respectively. Atlantic menhaden avoided 3.2, 3.6, 2.9, and 3.0 mg sulfite/l at acclimation temperatures of 15, 20, 25, and 30 C, respectively. Acclimation tempera-

ture was an important factor influencing the avoidance response of each species exposed to sulfur dioxide. Striped bass avoided lower concentrations of sulfite than Atlantic menhaden at 15 and 20 C. Both species avoided approximately the same concentration of sulfite at 25 C. Atlantic menhaden avoided lower concentrations of sulfur dioxide than striped bass at 30 C. (Author's abstract)
W86-01679

EFFECT OF SEWAGE SLUDGE ON MICROBIAL ACTIVITY IN AN OLD, ABANDONED MINESOIL,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W86-01702

BIOGEOCHEMISTRY OF LEAD IN MCDONALDS BRANCH WATERSHED, NEW JERSEY PINE BARRENS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W86-01703

LEAD DISTRIBUTION AND FLUXES IN A HIGH-ELEVATION FOREST IN NORTHERN VERMONT,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 5B.
W86-01706

EFFECTS OF PO RIVER INDUCED EUTROPHICATION ON THE DISTRIBUTION AND COMMUNITY STRUCTURE OF CILIATED PROTOZOAN AND METAZOAN POPULATIONS IN THE NORTHERN ADRIATIC SEA,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Centar za Istrazivanje Mora.
N. Revelante, M. Gilmartin, and N. Smodlaka.
Journal of Plankton Research, Vol. 7, No. 4, p 461-471, 1985. 2 Fig, 4 Tab, 22 NSF grant F7FO22Y and Smithsonian Institution grant JF-10-SMI.

Descriptors: *Protozoa, *Invertebrates, *Eutrophication, *Po River, *Adriatic Sea, Water pollution effects, Zooplankton, Mixing, Stratification, Seasonal variation, Abundance, Distribution.

The ciliated protozoans and micrometazoans in the northern Adriatic were repeatedly sampled and analyzed during summer and winter periods, with emphasis on quantifying the changes in abundance, and community structure, associated with a trophic gradient created by the discharge of the Po River. The community was characterized by major groups, organism abundance and volume, and size class frequency. The microzooplankton biomass increased 2- to 3-fold toward the western side of the Adriatic off the Po delta, during both 'mixed' and 'stratified' seasons, with increases in both the ciliated protozoans and micrometazoan components. At eutrophic sites and under 'stratified ' conditions a marked increase in the relative abundance of ciliated protozoans was observed, with a relative increase in tintinnid contribution to the total ciliated protozoan biomass. Although marked changes in the ciliated protozoan biomass occurred, little change in their size class structure occurred except as influenced by inflowing waters from the central Adriatic. (Author's abstract)
W86-01757

ABUNDANCE OF WEST INDIAN MANATEES (TRICHECHUS MANATUS) AROUND SELECTED FLORIDA POWER PLANTS FOLLOWING WINTER COLD FRONTS, 1982-1983,
Eckerd Coll., St. Petersburg, FL. Dept. of Biology.
J. E. Reynolds, and J. R. Wilcox.
Bulletin of Marine Science, Vol. 36, No. 3, p 413-422, 1985. 1 Fig, 4 Tab, 21 Ref.

Descriptors: *Manatees, *Powerplants, *Water temperature, *Florida, Air temperature, Behavior, Thermal pollution, Abundance.

Seven 1-day aerial surveys were flown during winter, 1982-1983, to assess manatee abundance. The surveys focussed on five Florida Power and Light Company plants: Cape Canaveral (PCC), Riviera (PRV), Port Everglades (PPE), Lauderdale (PFL), and Ft. Myers (PFM). Of the 1,191 manatees sighted during the surveys, 930 were present in the immediate vicinity of the plants. Ten percent of the total animals sighted were calves, with the highest percentage of calves (13.6%) being present at PFM. Maximum counts of manatees for each plant were as follows: PCC, 15; PRV, 98; PPE, 56; PFL, 16; PFM, 85. With the exception of PRV's maximum count, of the 1982-1983 maxima represent the lowest maximum counts for the respective plants in 6 years of surveys. The low counts most likely reflect the mild winter temperatures. With the exception of PFM, there is no indication that any regional manatee populations have declined significantly. Seventeen regressions compared the following variables: intake water temperature at power plants, mean daily air temperature, and number of manatees observed at each plant. Significant correlations were found only for three regressions of water temperature and number of manatees, for one regression of air temperature and number of manatees, and for one regression of all variables. The remaining regressions indicated correlations that were not significant, supporting the contention that winter cold was not of sufficient intensity or duration in 1982-1983 to cause large numbers of manatees to aggregate. (Author's abstract)
W86-01758

INVESTIGATION OF A EUTROPHIC TIDAL BASIN: PART 2 - NUTRIENTS AND ENVIRONMENTAL ASPECTS,
Southern Water Authority, Otterbourne (England). Resources Planning Lab.
H. A. C. Montgomery, P. G. Soulsby, I. C. Hart, and S. L. Wright.
Marine Environmental Research, Vol. 15, p 285-302, 1985. 1 Fig, 4 Tab, 18 Ref.

Descriptors: *Eutrophication, *Tidal basins, *Nutrients, Wastewater pollution, Water pollution sources, Sediments, Phosphorus, Nitrogen, Cycling nutrients, Algal growth.

The eutrophication of Langstone Harbour, a large tidal basin, has been studied by statistically designed nutrient surveys. Rates of input of nutrients from the sea, from effluent discharges and from other sources, have been estimated. Sediment/water interactions have been shown to be important in the phosphate budget of the basin, but they are less important in the nitrogen budget. Deductions were made about the relative importance of the various inputs and processes affecting concentrations of nutrients in the water column. It is concluded that ecologically or aesthetically detrimental growths of macroalgae are unlikely to occur in Langstone Harbour in the foreseeable future and that the removal of nutrient inputs, formerly thought to be necessary, will not, in fact, be required. The principles of the experimental design and of interpreting the data are of general applicability to tidal waters where the ratio of natural to man-made inputs needs to be known, where eutrophication is, or is expected to become, a problem, or where the progressive accumulation of nutrients by recycling is suspected. (Author's abstract)
W86-01789

COMBINED EFFECTS OF SALINITY AND CADMIUM CHLORIDE UPON EMBRYOS AND LARVAE OF THE JAPANESE OYSTER, CRASSOSTREA GIGAS,
Institut Francais de Recherche pour l'Exploitation de la Mer, Arcachon.
R. Robert, and E. His.
Marine Environmental Research, Vol. 15, p 303-312, 1985. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Salinity, *Cadmium chloride, *Oysters, *Embryos, *Larvae, Water pollution effects, Heavy metals, Cadmium compounds, Water pollution, Immature growth stages.

Following the observation of high concentra
of cadmium in Gironde estuarine waters, th
sponse of embryos and larvae of the Jap
oyster, Crassostrea gigas to this heavy met
various salinity regimes was studied for 10 da
the laboratory. The experimental design was
4 factorial experiment using concentrations of
mium of 0.10, 20 and 50 micro-g/liter and sali
of 20, 25, 30 and 35%. Statistical analysis indi
that the salinity changes have important effec
the embryonic development, survival and gr
of C. gigas larvae. No deleterious effect o
toxin at all cadmium concentrations and no int
tion between cadmium and salinity were fo
(Author's abstract)
W86-01790

**TRACE METALS IN BIVALVE MOLLU
FROM THAILAND,**
Environmental Protection Agency, Kow
(Hong Kong).
D. J. H. Phillips, and K. Muttarasin.
Marine Environmental Research, Vol. 15, p
234, 1985. 1 Fig, 8 Tab, 35 Ref.

Descriptors: *Trace metals, *Mollusks, *Tha
Cadmium, Chromium, Copper, Iron, Lead, Ni
Mercury, Zinc, Clams, Cockles, Mussels, Oy
Shellfish, Public health.

Capture fisheries and aquaculture provide a
quantity of bivalve molluscs for human cons
tion in Thailand each year. The existing info
tion on trace elements in these bivalves is frag
tary and contradictory. This paper reports da
eight metals (cadmium, chromium, copper,
lead, nickel, mercury and zinc) in the four m
species marketed. These are the clam Paphia u
lata, the cockle Anadara granosa, the green m
Perna viridis and the rock oyster Crassostrea
mercialis. The bivalves analyzed were tak
markets or in the field to cover as many o
major sources as possible. The results indica
major threat to public health from trace ele
in these species from Thailand and lend confi
to the expansion of aquaculture operations. In
ticular, the levels of lead found in the sa
analyzed are considerably lower than those p
ously reported by other authors. (Author's
stract)
W86-01791

**EFFECTS OF OIL AND A DISPERSANT
INTERTIDAL ORGANISMS IN FIELD
PERIMENTS WITH A MESOCOSM, THE
MERHAVEN CAISSON,**
Institut fuer Meeresforschung, Bremerhaven
many, F.R.).
H. Farke, K. Wonneberger, W. Gunkel, and G
Dahlmann.
Marine Environmental Research, Vol. 15,
114, 1985. 5 Fig, 2 Tab, 23 Ref.

Descriptors: *Oil pollution, *Dispersants, *In
dal areas, *Benthos, Water pollution effects, B
ria, Sediments, Hydrocarbons, Benthic f
Benthic flora, Mesocosms.

Three medium-scale field experiments on th
fects of oil, a dispersant and an oil/dispersant
ture were carried out in an intertidal muc
ecosystem of the Wadden Sea (German Bi
For six successive tides each contaminant
added to the water enclosed in a mesocosm d
submersion of the flat. The fate of the oil i
sediment and effects on phytobenthos, bacteri
macrozoobenthos were studied. Penetration o
oil into the sediment was mainly observed a
surface layer. Higher oil concentrations and l
boiling polycyclic hydrocarbons were pe
when oil was chemically dispersed. Subletha
fects were found in some macrofauna specie
duced feeding activity) and in phytobenthic
nisms (increased activity); oil degrading bac
increased. No major effects were observed
the dispersant alone was added. (Author's abs
W86-01792

R AND SILVER ACCUMULATION IN PLANTED AND RESIDENT CLAMS MA BALTHICA) IN SOUTH SAN ISCO BAY,
cal Survey, Menlo Park, CA.
nary bibliographic entry see Field 5A.
793

ANCE OF BATHYPOREIA PILOSA ROM (AMPHIPODA: HAUSTORII- O ORGANIC AND INORGANIC SALTS RCURY,
le Recherches Marines, Jounieh (Leba-

nayrallah.
Environmental Research, Vol. 15, p 137- . 6 Tab, 52 Ref.

ors: *Mercury compounds, *Amphipods, , Salinity, Temperature, Age, Heavy Organic compounds, Bioaccumulation, chloride, Ethyl mercuric chloride.

tests of mercuric chloride and ethyl mer- oride were run on Bathyporeia pilosa. lred-and-eight factorial combinations yzed for each mercurial compound (three three temperatures, two age groups and ry concentrations). These were comple- y an investigation on the uptake and tion potential of these two compounds sa. Toxicity of the inorganic and organic was seen to be directly related to both tion and temperature and inversely relat- ity and age. Sublethal effects were stud- lated to the four parameters investigated. tion of the organic mercury compound t twice as rapid as that of the inorganic ough death occurred where animals con- y similar levels of mercury. (Author's

CE OF CYCLIC EXPOSURE ON THE LATION OF HEAVY METALS BY EDULIS PLANULATUS (LA-

Univ., Hobart (Australia). Dept. of Zool-

tt, R. Swain, and D. A. Ritz.
vironmental Research, Vol. 15, p 17-30, , 6 Ref.

s: *Bioaccumulation, *Heavy metals, Cadmium, Copper, Lead, Zinc, Cyclic

ion of cadmium, copper, lead and zinc ues of Mytilus edulis planulatus was nder cyclic conditions of exposure in ablish whether the rate of accumulation l is proportional to the time exposed to d concentrations. When exposed to a l, the accumulation of lead and zinc was portional to the exposure time, but that as not. Under simultaneous exposure to tals both lead and cadmium were accu- direct proportion to the exposure time, er and zinc were not. Accumulation of etals cadmium, copper and zinc was by the presence of other metals. (Au- ct)

OF DREDGING AND DUMPING ON OF SAINT JOHN HARBOUR,

of Fisheries and Oceans, St. Andrews wick).
h, and M. L. H. Thomas.
ironmental Research, Vol. 15, p 45-57, l Tab, 18 Ref.

*Dredging, *Dumping, *Ecological int John Harbor, *New Brunswick, ater pollution effects, Species compo- haetes.

poverished communities of benthic a in Saint John Harbor, three were attributable to anthropogenic causes: disposal of solid wood wastes, dredging, and dumping activity. Circumstantial evidence indicates that the fourth community resulted from strong tidal currents present in the inner harbor interacting with the sediment causing periodic erosion and deposition, resulting in an impoverished macro-infauna. The dredged area was rapidly recolonized; first by invasive species such as Capitella capitata and Nereis sp. and then by species present in adjacent sediments. The area adversely affected by dumping was of limited extent: of the order of 1 sq km, as indicated by the presence of exotic species in dump soil and the distribution of organic carbon. (Author's abstract)
W86-01798

CHLORINATED HYDROCARBONS AND HATCHING SUCCESS IN BALTIC HERRING SPRING SPAWNERS,
Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene.
P. D. Hansen, H. von Westernhagen, and H. Rosenthal.
Marine Environmental Research, Vol. 15, p 59-76, 1985. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *Chlorinated hydrocarbons, *Herring, *Fish, *Water pollution effects, *Spawning, *Hatching, Toxicity, Polychlorinated biphenyls, DDD, DDE, Pesticides, Growth stages.

Eggs from 69 females of spring spawning herring from the German Baltic coast (Travemunde, April 1979) were incubated in clean sea water (20 0/00 S, temperature 8 C) under standard conditions. Sixty-one trials could be used for the evaluation of hatching success. Viable hatch was taken as a measure to evaluate the effects of chlorinated hydrocarbons accumulated in gonads, liver and muscle of parental fish. PCB levels in running ripe females ranged on a wet weight basis between 19 and 241 ng/g (gonad), 20 and 377 ng/g (liver) and 11 and 1820 ng/g (muscle). Concentrations of other chlorinated hydrocarbons (DDD, DDE, gamma-HCH, etc.) were in the same range as reported by other authors for Baltic herring. Viable hatch was significantly affected at ovary DDE concentrations higher than 18 ng/g (wet wt) and PCB concentrations of more than 120 ng/g (wet wt). (Author's abstract)
W86-01799

STUDY OF THE TOXICITY OF SOME SILICONE COMPOUNDS IN RELATION TO MARINE BIOLOGICAL CHAINS,
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, J. Aubert, H. Augier, and C. Guillemaut.
Chemosphere, Vol. 14, No. 1, p 127-138, 1985. 10 Fig.

Descriptors: *Toxicity, *Silicone compounds, *Marine environment, *Food chains, Organosilicone compounds, Fish, Crustaceans, Mollusks, Bioaccumulation, Phytoplankton, Water pollution effects.

The trophic chain method developed in the laboratory is intended to reconstruct simplified but characteristic ecosystems and thus to provide a predictive method of studying the effects of chemical pollution on the various links in marine trophodynamic chains. The trophodynamic chain method was used in a study of the toxicity of organosilicone compounds and their emulsifier to marine biological chains. The trophodynamic chains studied include a fish benthic chain, a crustacean benthic chain, a mollusk chain and a pelagic chain. The accumulation factors are generally very low (from 0.036 to 2.08). The transfer factor is highest within the pelagic and neritic chains, where the first stage comprises phytoplankton. The silicone compound behaves, at least for a while, as a persistent pollutant, but the transfer and accumulation phenomena are extremely reduced and consequently it does not seem likely that harmful effects will be passed on to the consumer at the end of the chain. (Moore-IVI)
W86-01853

FATE AND TOXICITY OF HIGH DENSITY MISSILE FUELS RJ-5 AND JP-9 IN AQUATIC TEST SYSTEMS,
Georgia State Univ., Atlanta. Dept. of Biology.
J. C. Spain, and C. C. Somerville.
Chemosphere, Vol. 14, No. 2, p 239-248, 1985. 5 Fig, 2 Tab, 7 Ref.

Descriptors: *Fate of pollutants, *Fuels, *Water pollution effects, Biodegradation, Path of pollutants, Microorganisms, Shrimp, Sorption, Volatilization, Toxicity, Sediments.

The fate of the fuel components in lab test systems containing water and sediment collected from natural aquatic habitats was measured. Because the high density components seemed to be persistent, the toxicity of the fuels to microorganisms and Mysidopsis bahia were also examined. The difference in density between RJ-5 and JP-9 seems to determine the differences in their fate in aquatic systems. Volatilization of the components from JP-9 is much faster than from RJ-5 because JP-9 floats on the surface of the water. The difference is particularly notable with endo-endo-dihydrodi(norbornadiene) which is present in both fuels; it volatilized from JP-9 mixtues within a few days yet remained for much longer periods in RJ-5. Sorption to the sediment greatly reduced the volatilization of both fuels. The norbornadiene dimers have a higher affinity for sediment than the cyclopentadiene dimers but both types of compounds resisted weathering in the presence of sediment. The structural features of the high density synthetic molecules make them very resistant to microbial attack. Biological transformations of the norbornadiene dimers by the insertion of an oxygen atom were not detected. The fuels were not toxic to microorganisms at low to moderate concentrations but RJ-5 was toxic to mysid shrimp. The recalcitrance of RJ-5 to microbial degradation, affinity for sediment, density, and toxicity to aquatic macrobiota, suggest that a large-scale spill of the fuel could present major environmental problems. JP-9 appears to be much less of a potential problem in the aquatic environment than RJ-5 because of its higher vapor pressure and lower density. (Baker-IVI)
W86-01854

PREDICTING THE EFFECT OF TOXIC SUBSTANCES ON PELAGIC ECOSYSTEMS,
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
U. Borgman.
Science of the Total Environment, Vol. 44, p 111-121, 1985. 4 Tab, 20 Ref.

Descriptors: *Ecosystems, *Toxicity, *Prediction, Biomass size spectrum, Lake Ontario, Zooplankton, Phytoplankton, Fish, Body size, Water pollution effects, Growth, Nutrient load.

Recent advances in the description of pelagic ecosystems using the biomass size spectrum can be adapted to predict the effect of toxic substances on whole ecosystems. The method is demonstrated using Lake Ontario as an example. First, the shape of the biomass size spectrum is predicted. Using a previously published estimate of particle-size conversion efficiency (-log(biomass conversion efficiency)/log(predator-prey size ratio)), and an estimated exponent of the allometric relationship between body size and turnover rate of 0.24, the biomass over logarithmically equal size classes in Lake Ontario is estimated to be proportional to body size raised to the exponent-0.02. The biomass within various size classes is then estimated from data on zooplankton and phytoplankton biomass. Total biomass, from algae to fish, is estimated to be 7-16 g/sq m dry weight. The change in biomass and production over various size classes after addition of a toxic substance can then be predicted if the total nutrient load remains relatively constant and if the effect of the substance on biomass conversion efficiency is known. A toxicity sufficient to decrease growth and conversion efficiency by 50% is predicted to reduce production of large fish by 91%, but phytoplankton production by only 12% in the lake. Fish biomass is predicted to drop substantially, phytoplankton biomass should rise,

and zooplankton biomass should remain relatively unaffected. (Author's abstract)
W86-01865

DETOXIFICATION OF COPPER IN THE CELLS OF THE DIGESTIVE GLAND OF MUSSEL: THE ROLE OF LYSOSOMES AND THIONEINS,
Genoa Univ. (Italy). Ist. di Fisiologia Generale.
A. Viarengo, M. N. Moore, M. Pertica, G. Mancinelli, and G. Zanicchi.
Science of the Total Environment, Vol. 44, p 135-145, 1985. 4 Fig, 1 Tab, 26 Ref.

Descriptors: *Mussels, *Copper, *Toxicity, Lysosomes, Thioneins, Digestive gland, Heavy metals, Detoxification, Water pollution effects.

The data reported shows that copper is naturally present in the lysosomes and residual bodies of mussel digestive gland, the concentration of the metal being greatly increased for mussels exposed to Cu(2+) (0.04 ppm) for 3 days and then detoxified for 6 days. A procedure has been devised to solubilize the copper that is present in an insoluble form in lysosomes and residual bodies. This procedure disrupts lysosomes with sonication and solubilizes Cu-protein complexes in a hypotonic solution containing 1% 2-mercapto-ethanol and a mixture of antiproteolytic agents. The solubilized copper, representing more than 80% of the total metal present in the organelles, has been found mainly bound to a protein showing characteristics similar to those of metallothioneins: it has a high metal content, a molecular weight of about 12000 as evaluated by gel filtration, a relatively low UV absorbance at 280 nm and a high -SH content, as evaluated by the Shikata orcein cytochemical technique. The lysosomal extracts from the digestive gland of controls contain low basal levels of this copper-rich thionein-like protein which increases 5-6 times when the mussels are exposed to copper (0.04 ppm) for 3 days and then detoxified for 6 days. (Author's abstract)
W86-01866

ACID DEPOSITION AND DRINKING WATER,
Wisconsin Univ.-Madison. Center for Limnology.
M. E. McDonald.
Environmental Science and Technology, Vol. 19, No. 9, p 772-776, 1985. 1 Fig, 1 Tab, 45 Ref.

Descriptors: *Acid rain, *Public health, *Drinking water, Aluminum, Copper, Cadmium, Corrosion, Asbestos, Lead, Groundwater, Surface water, Acid deposition, Water pollution effects.

Acid deposition could affect human health indirectly through two principal routes: bioaccumulation of chemicals in human food and contamination of drinking water. Acid deposition has been shown detrimental to aquatic ecosystems because of increased mobilization of trace metals. Acid deposition may enhance the scavenging of atmospheric contaminants, mobilize natural or synthetic contaminants in catchment areas, and promote corrosion of drinking water distribution systems. Numerous problems are associated with assessing human health risks from drinking contaminated water, such as subchronic effects, latency, antagonism, synergism, and general etiology. One of the most basic deals with the amount of water a person consumes daily. Contaminants of particular concern to human health include mercury, aluminum, copper, cadmium, lead, and asbestos. The source of drinking water is an important factor in determining its potential for being detrimentally affected by acid deposition. The major sources are groundwater and surface water. Other sources include cisterns and water suppliers. Research is needed to provide better estimates of affected populations and of the existing levels of the various contaminants in drinking water to which the affected populations are exposed. (Baker-IVI)
W86-01867

VARIABILITY OF ALUMINUM CONCENTRATIONS IN ORGANS AND WHOLE BODIES OF SMALLMOUTH BASS (MICROPTERUS DOLOMIEUI),
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5A.
W86-01872

BIOAVAILABILITY AND BIOTRANSFORMATION OF AROMATIC HYDROCARBONS IN BENTHIC ORGANISMS EXPOSED TO SEDIMENT FROM AN URBAN ESTUARY,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5B.
W86-01873

BIOCONCENTRATION FACTORS OF SOME HALOGENATED ORGANICS FOR RAINBOW TROUT: LIMITATIONS IN THEIR USE FOR PREDICTION OF ENVIRONMENTAL RESIDUES,
National Water Research Inst., Burlington (Ontario). Environmental Contaminants Div.
B. G. Oliver, and A. J. Niimi.
Environmental Science and Technology, Vol. 19, No. 9, p 842-849, 1985. 1 Fig, 7 Tab, 49 Ref.

Descriptors: *Biological magnification, *Trout, *Chlorinated hydrocarbons, *Brominated hydrocarbons, *Fish, Water pollution effects, Partition coefficients, Bioaccumulation, Lake Ontario, Animal tissues.

The bioconcentration factors, BCF's, for 34 chlorinated and brominated chemicals in rainbow trout have been determined by the steady-state approach by using chemical water concentrations in the nanogram per liter range. In addition, for 13 chemicals with a known half-life in trout, BCF's were also estimated by using the kinetic approach. The two methods gave comparable results for compounds with short half-lives in the fish but significantly different results for longer half-life chemicals. The BCF's have been shown to correlate well with octanol/water partition coefficients, Kow, for many of the study compounds. But the BCF's of high molecular weight compounds and compounds metabolized by the fish did not correlate with Kow. The laboratory-derived BCF's were compared to field-derived BCF's for Lake Ontario rainbow trout. This comparison showed that predictions based on laboratory BCF's were useful for chemicals with short half-lives in fish but were much too low for long half-life chemicals, where contaminated food is the major chemical source. (Author's abstract)
W86-01874

GROWTH RESPONSE OF YELLOW-POPLAR (LIRIODENDRON TULIPIFERA L.) SEEDLINGS TO OZONE, SULFUR DIOXIDE, AND SIMULATED ACIDIC PRECIPITATION, ALONE AND IN COMBINATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Plant Pathology and Physiology.
A. H. Chappelka, B. I. Chevone, and T. E. Burk.
Environmental and Experimental Botany, Vol. 25, No. 3, p 233-244, 1985. 2 Fig, 4 Tab, 39 Ref.

Descriptors: *Poplar trees, *Acid rain, *Water pollution effects, *Ozone, *Sulfur dioxide, Plant growth, Air pollution, Trees.

Nine-week-old, half-sib, yellow-poplar were exposed to O3 and/or SO2 (controls, 0.10 ppm O3, 0.08 ppm SO2 or 0.10 ppm O3 + 0.08 ppm SO2, 4 hr/d/wk) in combination with simulated rain (pH 3.0, 4.3 or 5.6 1 hr/d, 2d/wk at 0.75 cm/hr) for 6 wk, with rain applied either just before or after fumigation. Across all rain treatments, O3 + SO2 resulted in a significant decrease in height growth and dry matter production and an increase in leaf area ratio (LAR) compared with controls. The combined effect of O3 and SO2 was additive in nature, except for root dry weight and leaf weight ratio (LWR) in which a greater than additive response was observed. The alteration in LAR was due to dry matter remaining in the leaves as indicated by an increase in LWR. Rain treatments altered leaf dry weight which appeared as a quadratic function across all pollutant treatments. A significant gaseous pollutant x rain pH interaction occurred for root dry weight, leaf area increase, mean relative growth rate (RGR), mean uni
rate (ULR) and chlorophyll content. Ozone
sure resulted in a linear decrease in roo
weight, leaf area increase, RGR and ULR,
acidity of rain increased (decreased pH), wh
fumigation with SO2 resulted in an increa
these growth variables as rain pH decreased.
rophyll content increased in both O3 and
treatments as the acidity of rain increased. Fu
tion of wet leaves caused a significant reducti
dry matter production, shoot elongation, leaf
RGR and ULR as compared with dry
across all treatments. The results of this
demonstrate that the effects of multiple poll
stresses are more deleterius than any single p
ant exposure for these half-sib seedling trees.
findings are discussed relative to possible im
tions on the effects of gaseous pollutants in c
nation with acidic precipitation on yellow-p
growth and productivity. (Author's abstract)
W86-01876

**CONTAMINANT LEVELS IN COLONIAL
TERBIRDS FROM GREEN BAY AND
MICHIGAN, 1975-80,**
G. H. Heinz, T. C. Erdman, S. D. Haseltine, a
C. Stafford.
Environmental Monitoring and Assessment,
3, No. 3, p 223-236, September, 1985. 3 Ta
Ref.

Descriptors: *Water birds, *Pesticide res
*Halogenated hydrocarbons, *Green Bay,
Michigan, Mercury, Polychlorinated biph
Polybrominated biphenyls, Polychlorinated
enes, DDE, Dieldrin, Diets, Gulls, Herons, E

Residues of organochlorine pesticides, polyc
nated biphenyls (PCBs), polybrominated biph
(PBBs), polychlorinated styrenes (PCSs), and
cury were measured in the eggs of 10 speci
colonial waterbirds nesting in areas around
Bay or Lake Michigan from 1975 to 1980. Res
also were measured in the carcasses and brai
black-crowned night-herons (Nycticorax
corax). The highest residues were of PCBs,
mercury, and dieldrin; for some species, lev
these chemicals possibly were high enough to
caused reproductive effects. Other organochl
pesticides were found at low levels. Only
amounts of PCBs and PBBs were found. Eg
herring gulls (Larus argentatus) collected in
from an island in Lake Michigan containe
average of 100 ppm PCBs and 33 ppm DDE
was the most-contaminated species. Cattle e
(Bubulcus ibis), the only bird that is not a
eater, contained only small quantities of DDE
mercury. (Author's abstract)
W86-01885

**INSECTICIDE RESISTANCE IN MOSQU
FISH OF THE LOWER RIO GRANDE VA
OF TEXAS - AN ECOLOGICAL HAZARD,**
Columbia National Fisheries Research Lab., V
ria, TX. Field Research Station.
J. K. Andreasen.
Archives of Environmental Contamination
Toxicology, Vol. 14, No. 5, p 573-577, Septe
1985. 1 Fig, 2 Tab, 27 Ref.

Descriptors: *Insecticide resistance, *Mosquit
*Rio Grande Valley, *Texas, Pesticide tox
Genetics, Toxaphene, DDE, Pyrethriod in
cides, Bioaccumulation, Insecticides, Water p
tion effects.

Large-scale agricultural development in the L
Rio Grande Valley makes this an ideal locatio
examining genetic resistance in fish popula
Acute toxicity tests using mosquitofish sh
that a population from the Lower Rio Gr
Valley of Texas had developed resistance to
phene and cross resistance to DDE but n
pyrethroid insecticides. At toxaphene exp
concentrations up to 4,000 micro-g/l (4 ppm)
30% of the fish from the Lower Rio Gr
Valley survived and the 96 hr LC50 was estim
to be 790 micro-g/l. Control mosquitofish tha
no known pesticide exposure did not surviv
toxaphene concentrations greater than 32 micr

ie 96 hr LC50 was 6.5 micro-g/l. Tests geny from resistant parents showed that eneration was also resistant. Resistant mos- bioaccumulate large body residues of or- rine pesticides that apparently cause no for mosquitofish. Consumption of resist- nay be hazardous to fish or avian preda- may be one factor contributing to an population decline of some species in Texas. The ability to develop cross resist- preadapt a population to certain pesti- thereby create a potentially hazardous when new chemicals are introduced. VI)
9

INANT RESIDUES IN FISH AND NTS FROM LAKES IN THE ATCHA- RIVER BASIN (LOUISIANA),
National Fisheries Research Lab., MO.
ry bibliographic entry see Field 5B.
0

OF TOLUENE ON FATHEAD (PIMEPHALES PROMELAS RA- E) DEVELOPMENT,
n Univ., Seattle. Dept. of Pathology.
lin, J. D. Brammer, and R. L. Puyear.
of Environmental Contamination and y, Vol. 14, No. 5, p 595-603, September, ig, 1 Tab, 42 Ref. Air Force grant 8-3709 and NIH grant 5T32ESO7032.

s: *Toluene, *Fathead minnows, *Em- oxicity, Hydrocarbons, Aromatic com- ater pollution effects, Immature growth

y of highly refined petroleum products resent a potential source of contamina- fuel. Toluene is a major aromatic in the ble fraction of the jet fuel JP-4. The luene on teleost development was exam- controlled conditions. Young fathead mbryos 1-2 hr old were continuously 30-45 mg/l toluene for 14 to 124 hr. os as well as serial sections of paraffin- embryos were examined to determine he toxicant. Abnormalities noted under tions included distorted embryonic axis, eart and circulatory system develop- ation and swelling of the pericardial morrhaging, and overall stunted appear- ophthalmia, and a unique migration of ly located yolk syncytial layer and its uclei. Toluene concentration necessary rphological responses were high, and roached in the environment only under nditions such as a major spill in a con- (Moore-IVI)

ON OF GROWTH OF FRESHWATER GAE BY LONG-CHAINED ALI- MINES EMPLOYED IN SOLVENT ON PROCESSES,
Univ. (Sweden). Dept. of Botany.

f Environmental Contamination and Vol. 14, No. 5, p 609-620, September, 7 Tab, 48 Ref.

*Aliphatic amines, *Algal growth, ity, *Solvent extraction, Bioassay, Dia- ophyta, Chlorophyta, Amines, Water ects, Industrial wastewater.

ce on algal growth by six longchained ines, used in industrial solvent extrac- es, was investigated by a conventional nd, in addition, a simple assay where grown in liquid medium in 250 micro-l microtitration plates. Loss of solvent rom processes to ambient water repre- ntial environment problem. The pri- dary, tertiary and quaternary amines xception) had EC50-values based on (ECr) or algal biomass (ECb) at 0.01- 0-800 nM). This makes long-chained ines about a thousand times more toxic than short-chained amines on a molar basis. The difference in toxicity was interpreted as being due to different modes of action between the two groups of amines. The diatom Asterionella formosa and the blue-green algae Anabaena flos-aquae were more sensitive to the amines than the green-algae Selenastrum capricornutum, Monoraphidium pusillum or Chlorella emersonii. The maximum ECma/ ECmin ratio recorded was 19.5, for the primary amine. Anabaena flos-aquae was more sensitive by a factor 2-4 when grown under nitrogen fixation conditions than when supplied with combined nitrogen. Compared to other aquatic organisms, the algae show a particular sensitivity to amines. The microtitration test system was less sensitive than the flask test system. The low sensitivity of the microtitration test system is not an inherent property, but due to the use of an insensitive technique (visual inspection) for detection of algal biomass. The ECr50 and ECb50-values in the flask test system were both heavily time-dependent. (Author's abstract)
W86-01893

LYSOSOMAL ENZYME RELEASE IN THE BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS RAFINESQUE) EXPOSED TO CADMIUM,
Michigan State Univ., East Lansing. Pesticide Research Center.
D. J. Versteeg, and J. P. Giesy.
Archives of Environmental Contamination and Toxicology, Vol. 14, No. 5, p 631-640, September, 1985. 9 Tab, 50 Ref.

Descriptors: *Sunfish, *Cadmium, *Enzymes, Toxicity, Water pollution effects, Stress, Starvation, Biological magnification, Bioaccumulation.

Lysosomal membrane lability and enzyme activities were measured in gill and liver tissues of the bluegill sunfish (Lepomis macrochirus). Exposure to sublethal cadmium concentrations for 10 or 21 days resulted in significant increases in the lability of liver lysosomal membranes, as measured by release of N-acetyl-Beta-D-glucosaminidase (NAG) and acid phosphatase (ACP). Acid phosphatase and NAG activites in liver were decreased by 10 day exposure to cadmium. However, after 21 days of exposure, liver NAG activity was elevated. Cadmium exposure did not affect the lysosomal lability index or the total enzyme activity of lysosomes isolated from gill tissue. In vitro exposure of isolated liver lysosomes to cadmium demonstrated that the increase in membrane lability was not a direct effect of cadmium on the lysosome. Stress induced by crowding the fish had no effect on liver lysosomal membrane lability. Starved bluegill sunfish had significantly destabilized lysosomes, as measured by both NAG and ACP. However, starvation did not affect the total activity of either enzyme. Neither size nor sex had any affect on lysosomal membrane lability, which indicates that field experiments will not be confounded by these factors. The problem of metal bioconcentration in fish has created the need for diagnostic tests which can be utilized to understand the biological effects of these contaminants on fish. The lysosomal membrane lability assay currently holds promise for use as a health monitoring tool. (Author's abstract)
W86-01894

ACTIVATION OF POLYCYCLIC AROMATIC HYDROCARBONS BY HEPATIC S-9 FROM A MARINE FISH,
North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences.
D. M. Milling, and M. B. Maddock.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 301-307, September, 1985. 2 Fig, 13 Ref. EPA Grant R811134.

Descriptors: *Polycyclic aromatic hydrocarbons, *Activation, *Fish, Hydrocarbons, Aromatic compounds, Aquatic life, Genotoxicity, Water pollution effects, Organic compounds.

The possibilities for monitoring aquatic systems for genotoxic hazards, including polycyclic aromatic hydrocarbons (PAH's) with cytogenetic assays of feral fish are being examined. Possible differences in metabolism by fish and mammalian systems or by different fish systems can influence the genetic effects of metabolism dependent genotoxic chemicals, such as the PAH's. A preliminary indication of the ability of toadfish S-9 to activate a series of weakly carcinogenic and mutagenic PAH's in the Salmonella assay was undertaken. The first experiment was designed to provide information on the mutagenicities in plate assays of single concentrations of four PHA's to Salmonella strains TA1527, TA1538, TA98,and TA100 with increasing concentrations of S-9 from untreated and 3-methylchlanthrene-pretreated toadfish. Comparison of the results of this study with toadfish S-9 and available data for mammalia S-9 does not suggest substantial differences in the ability to activate the PAH's tested. (Baker-IVI)
W86-01896

ACUTE TOXICITY OF FOUR PHENOXY HERBICIDES TO AQUATIC ORGANISMS,
Dow Chemical U.S.A., Midland, MI. Mammalian and Environmental Toxicology.
H. C. Alexander, F. M. Gersich, and M. A. Mayes.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 314-321, September, 1985. 4 Tab, 12 Ref.

Descriptors: *Herbicides, *Toxicity, *Phenoxy compounds, *Water pollution effects, Organic compounds, Aquatic life, Daphnia, Fish, Mortality.

The herbicides tested include 2,4-D, 2,4-D dimethylamine salt, 2,4-D isooctyl ester, and MXPA isooctyl ester. The 2,4-D isooctyl ester and MCPA isooctyl ester were not toxic to aquatic organisms (daphnia and fish) at their water solubility levels, 0.006 mg/l and 0.003 mg/l, respectively. Fish mortality observed in this study were attributed to low pH values, well within the range reported as being lethal to fish. Differences in acute toxicity values reported for 2,4-D on both invertebrates and fishes could be due to water quality. The daphnid acute toxicity value from this study for 2,4-D dimethylamine salt is significantly higher than earlier studies. Conversely, the acute fish toxicity of 2,4-D dimethylamine salt reported in this study and others was similar. The 2,4-D isooctyl ester has a low water solubility and exhibited no acute toxicity to aquatic organisms at nominal concentrations up to 1,000 times its water solubility. The acute toxicity data from these studies may be used to predict toxicity to aquatic life as a result of an accidental spill to the environment. (Baker-IVI)
W86-01898

METALS AND PCB CONCENTRATIONS IN MUSSELS FROM LONG ISLAND SOUND,
National Marine Fisheries Service, Milford, CT. Milford Lab.
R. A. Greig, and G. Sennefelder.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 331-334, September, 1985. 2 Tab.

Descriptors: *Polychlorinated biphenyls, *Metals, *Mussels, *Long Island Sound, Cadmium, Copper, Heavy metals, Water pollution.

Mussels were collected from the mouths of various rivers and inshore areas along the Connecticut shoreline and analyzed for cadmium, copper, and polychlorinated biphenyls (PCBs). Levels of PCBs in mussels from all ten stations sampled were low, ranging from a mean of 0.049 to 0.115 ppm wet weight. Mussel samples from six stations ranged in PCB levels from 0.049 to 0 068 ppm, whereas mussels from the remaining four stations ranged from 0.084 to 0.115 ppm. From a public health standpoint, both concentrations are quite low compared to the 5 ppm limit set by the FDA for PCBs in fish and shellfish. Copper levels were also low in all mussel samples, with means ranging from 1.0 to 2.3 ppm. Mussels from only two stations had the lower levels of 1.0 and 1.1 Cu, whereas mussels from the other stations had levels in the range of 1.7 to 2.3 ppm. The levels of cadmium in mussels were low, with the exception of those taken from Bridgeport where the mussels had a mean level of 5.1 ppm. Mussels from the other stations had mean

levels of cadmium ranging from 0.41 to 1.3 ppm. (Baker-IVI)
W86-01900

EFFECT OF SELENITE ON THE UPTAKE OF METHYLMERCURY IN COD (GADUS MORHUA),
Fiskeridirektoratet, Bergen (Norway). Inst. of Nutrition.
O. Ringdal, and K. Julshamn.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 335-344, September, 1985. 4 Tab, 18 Ref.

Descriptors: *Selenium, *Methylmercury, *Cod, *Fish, *Metals, *Mercury compounds, Toxicity, Water pollution effects, Heavy metals.

The possible interaction of methylmercury and selenium in different tissues of cod and in feeding diets supplemented with nontoxic levels of the elements was examined. There were no significant differences in the mercury uptake in the muscle between the groups with methylmercury exposure. The mercury concentration in muscle increased steadily in all three groups during the whole experimental period. The selenium supplement did not seem to influence the mercury uptake, quantitatively or with regard to the uptake rate in the muscle. Among the three tissues analyzed, the muscle accumulated the highest concentrations of mercury during the 32 days of exposure without selenium supplementation. The mercury concentration in the liver in one group increased to approximately 0.62 mg/kg after 8 days, and this level was constant through the rest of the experimental period. The total uptake of mercury in the brain increased with the selenium supplementation. While these experiments can offer no information on the mechanism of a methylmercury-selenium interaction in cod, the results indicate such an effect through the altered uptake of these elements in the liver and the brain. (Baker-IVI)
W86-01901

ABSORPTION OF CU++ BY LONG-TERM CULTURES OF DUNALIELLA SALINA, D. TERTIOLECTA, AND D. VIRIDIS,
Montclair State Coll., Upper Montclair, NJ. Dept. of Biology.
B. Lustigman, J. Korky, A. Zabady, and J. M. McCormick.
Bulletin of Environmental Contamination and Toxicology, Vol. 35, No. 3, p 362-367, September, 1985. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Copper, *Absorption, *Salinity, *Algae, *Metals, Aquatic plants, Fate of pollutants, Path of pollutants, Plasmalemma permeability.

The effect of salinity on the absorption of copper by algae was studied by means of atomic absorption analysis. Long term cultures of Dunaliella were used to determine if alterations in plasmalemma permeability occur as a result of adaptation to different osmotic conditions. Since copper appears to affect the mechanisms involved in osmotic resistance, Dunaliella does not exclude copper from the cell. As the extracellular concentration of Cu(++) increases, the intracellular accumulation rises proportionately, so that the intracellular Cu(++) is greater at 50 ppm than in the controls. The resistance of Dunaliella to heavy metals does not appear to be due to exclusion from the cells. Salinity has a significant effect on the amount of copper accumulated by the algal cells. The presence of TRIS in the medium acts to chelate Cu(++) and maintain its concentration to a steady level throughout the experiment. Copper binds to the cell surface and therefore causes alteration of the transport systems. In hypotonic medium the cells remained swollen, while in hypertonic they failed to shrink. Greater permeability in hyposaline medium than in hypersaline, is indicated by the increased absorption of copper into the 2%S cultures than the 6%S. The increased lethality in hypotonic medium may be due to increased water in flux or to greater permeability of copper into the critical regions of the cell. The inverse relationship of salinity and copper permeability may apply to other heavy metal ions as well, which may help to explain the resistance of Dunaliella to heavy metal toxicity. (Baker-IVI)
W86-01904

5D. Waste Treatment Processes

COLOR REMOVAL PROCESS FOR KRAFT PULP AND PAPER MILL EFFLUENTS,
Lakehead Univ., Thunder Bay (Ontario). School of Engineering.
R. G. Rosehart.
Water, Air, and Soil Pollution, Vol. 25, No. 3, p 275-284, July, 1985. 5 Fig, 5 Tab, 8 Ref.

Descriptors: *Kraft mills, *Pulp Wastes, *Wastewater treatment, *Color removal, Sulfates, Chemical oxygen demand, Co-precipitation, Aluminum, Calcium, Chemical treatment.

An optimized co-precipitation process for color removal from Kraft pulp and paper mill effluents is described. A split addition process with 115 mg/L Al(+3) and 500 mg/L Ca(+2) appeared to be optimal with a removal percentage of 90.2. The addition of small amounts of a polyelectrolyte A did result in some nominal improvement over the standard process. An Al(+3)/Ca(+2) ratio of 0.23 appeared to give optimal results with the final pH in the 4 to 5 range. Dried sludge produced from the process had a reasonable energy value when combusted in a bomb calorimeter. The chemicals used in the suggested process are commonly available in most kraft mills. For pH control use is made of the acid effluent streams within the mill. Significant COD and hence BOD5 reductions take place during the process which may result in some operational savings during biological secondary treatment. Further development work is needed on a pilot plant scale to further optimize chemical addition rates and conditions and to optimize the mixing and temperature conditions of operation. (Baker-IVI)
W86-01355

NUMERICAL SIMULATION OF RECTANGULAR SETTLING TANKS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
S. M. Abdel-Gawad, and J. A. McCorquodale.
Journal of Hydraulic Research, Vol. 23, No. 2, p 85-100, 1985. 7 Fig, 1 Tab, 24 Ref, 1 Append.

Descriptors: *Settling tanks, *Wastewater treatment, Sedimentation, Model studies, Simulation, Hydrodynamics, Strip integral method, Sediment transport.

The strip integral method (SIM) is proposed as a simple, and computationally efficient approach to simulate the steady hydrodyamics and sediment transport in settling tanks operating in a neutral density environment. The method assumes a dominant flow direction; the partial differential equations are first reduced by partial integration to a system of ordinary differential equations in terms of a few preselected parameters which are functions of the independent variable, x. These equations are then integrated by methods like Runge-Kutta to give the velocity, the concentration profiles along the tank length and consequently the tank removal efficiency. The method requires the modeller to choose suitable shape functions and to perform the partial integrations. The shape functions given are valid only for tanks that have geometries similar to that demonstrated. Other tank geometries require different shape functions. Work is now in progress to provide more shape functions for different inlet conditions. The method can adequately simulate the major flow features in the tank, the mixing characteristics, the concentration distribution and the removal efficiency. The stability and convergence of the SIM is determined by the number and form of the shape functions; the Runge-Kutta solution is affected by changing the integration step and the order of the truncation error. (Baker-IVI)
W86-01390

EXPERIMENTAL MANIPULATION OF TRIENTS AND WATER IN A FRESHW MARSH: EFFECTS ON BIOMASS, DECO SITION, AND NUTRIENT ACCUMULA
Manitoba Univ., Winnipeg. Dept. of Botany.
S. E. Bayley, J. Zoltek, A. J. Hermann, T. J. Dolan, and L. Tortora.
Limnology and Oceanography, Vol. 30, No 500-512, May, 1985. 6 Fig, 6 Tab, 25 Ref.

Descriptors: *Nutrients, *Marshes, *Biomass composition, *Wastewater disposal, Peat, lands, Phosphorus, Environmental effects, level.

Experimental freshwater marsh plots (2,000 received 9.6, 3.7, and 1.5 cm/wk of treated effluent and the control plot received 4.4 c potable water during a 2-year study. Surface elevation above the peat substrate averaged in the second year. During the first year the surface remained dry. Application of treated ent increased net primary production only the dry year. During the wet year there significant difference between the highest plot and the control plot in aboveground bi or in phosphorus content in the abovegroun or dead vegetation and in the belowground tion. Based on the 2 years of the study, a increase in water level above the marsh had the same effect on the marsh productio nutrient accumulation as did application of 4 sq m/yr in treated effluent. This was presu due to the release of P from the peat sub under flooded conditions. (Author's abstract)
W86-01414

RUSSIAN STUDY: CLO2, OXIDATION CYANIDES AND PHENOLS,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst dosnabzheniya, Kanalizatsii, Gidrotekhnich Sooruzhenii i Inzhenernoi Gidrogeologii, M (USSR).
A. N. Belevzev, and Yu. L. Maximenko.
Effluent and Water Treatment Journal, Vo No. 5, p 151-176, May, 1985. 9 Fig.

Descriptors: *Phenols, *Wastewater treat *Cyanides, *Chlorine dioxide, Oxidation, ones, Chlorination, Chemical reactions, Hyd bons.

The oxidation process rate of diatomic ph and quinones, depends on the interarrangeme hydroxyl groups and quinone grouping. benzol ring of phenol or proper quinone subjected to breaking up under chlorine di action if hydroxyl groups, or quinone grou are in para-position relative to each other an are destroyed more readily when the grou rangement is reproduced either in the meta tion or in ortho position. Methyl-derivativ quinone do not undergo destruction. Ph having methyl substituents in side chains ar dized only to methyl-quinone. The chlorine ide effect on waste effluents containing som cific substances was examined. The biochem treated refinery plant effluents that contained oxidized oily hydrocarbons and products wit ious degrees of oxidation were affected by ch dioxide. Experiments showed that the subst retained in the waste effluents detailed are ox only in the presence of a large excess quant ClO2; with maximum effect in strong al media. Removing COD by 90-95% is achiev using chlorine dioxide at a rate of 800-1000 Phenols contained in biochemically treated ery plant effluents in small concentrations (0. mg/l) are effectively oxidized by chlorine dio Their complete oxidation is obtained at ClO of 5 mg/l over the period of 10-15 minutes. results of comparative tests on phenol oxidati calcium hydrochlorite in the same effluent in ed that to achieve the same effect the activ chlorine required was twenty times greater. T fore chlorine dioxide utilization holds much p ise for advanced treatment of wastewaters phenols content in small concentrations. (B IVI)
W86-01440

SE OSMOSIS AND ULTRAFILTRA-OLVE SEPARATION PROBLEMS,
n Univ., SC.
ooding.
al Engineering, Vol. 92, No. 1, p 56-62, 1985. 87 Fig, 3 Ref.

tors: *Reverse osmosis, *Ultrafiltration, treatment, Wastewater treatment, Water Membrane processes, Membranes, Filtra-aporation.

ic principles of membrane separation are d and approaches are suggested to design ations and selection of membranes and nt for specific jobs. A separation process is selected on the basis of experience and an e evaluation of the alternatives. Analysis nosis and reverse osmosis assumes that the ie is impermeable to the solute, at least in on to the rate of solvent permeation. Ul-on obeys the same basic principle, and mplies the separation of macromolecules atively low molecular weight solvents. ortant factor to consider is the sensitivity rane permeability to factors other than ure. Aside from concentration polariza-ch represents a reduction in driving force, e permeability is subject to decline due to ion of supersaturated solute and to depo-gels and fine particulate debris that may dvertently with the feed. There are sever-criteria to be kept in mind in selecting ipment. A high membrane-surface-to-atio is good to minimize space require-d capital cost. Adequate structural sup-eeded to allow the thin membrane to the required pressure drop. Low pres-on the concentrate side of the membrane the driving force for permeation. Turbu-on the concentrate side or some alterna-as is needed to dissipate concentration on and minimize fouling. Ease of back-nd/or ease of membrane replacement is the event that fouling becomes a prob-g membrane life and low replacement d also be considered. (Baker-IVI)
l

ATER TREATING AT LANZHOU,
Refinery (China).

on Processing, Vol. 64, No. 6, p 78-79, . 3 Fig, 2 Tab.

s: *Wastewater treatment facilities, *China (Peoples Republic) *Refineries, vastewater treatment, Chemical oxygen qualization, Flotation, Activated sludge Filtration, Activated carbon.

efinery is a modern, integrated petro-nterprise in Gans Province, the Peoples f China. The principal purpose of refin-ina is to provide feedstocks for chemical ocess wastewater treatment system with c capacity of 1,200 t/h was constructed decontaminate the industrial wastewater, the Yellow River. The overall refinery ater treatment scheme consists of the sequential operations: equalization; oil/ls separation; chemical coagulation/dis-flotation; activated sludge treatment; ion, and granular activated carbon ad-Ancillary operations include sludge incineration and activated carbon re-The quality of process wastewaters ely. By using tertiary treatment, the ality does achieve the required national andards and approaches surface water er 30% of the treated effluent is reused ess water. An unusual feature of the lant is that it is the site of an attractive nployees with a fountain fed by plant aker-IVI)

NT OF WASTEWATER BY APPLI-O FOREST LAND,
niv., Brunswick. Marine Extension
W. L. Nutter, and J. L. Red.
Tappi Journal, Vol. 68, No. 6, p 114-117, June, 1985. 3 Tab, 11 Ref.

Descriptors: *Land disposal, *Wastewater disposal, *Forest watersheds, Industrial wastes, Municipal wastewater, Leaching, Wastewater renovation.

Forest land across the United States is receiving a variety of industrial and municipal wastewaters. This is particularly true in the Southeast where the availability of forest land makes this method of wastewater disposal particularly attractive. With proper design and operation procedures, drinking water standards for groundwater can be met, tree growth improved, and soil properties also improved. Three general pathways for water assimilation by land treatment are identified as biological degradation and/or plant uptake, accumulation in the soil, and leaching of mobile and nondegradable compounds to subsurface waters. The Unicoi forest is described as an example of a system that maintains excellent surface soil hydraulic properties, permitting all wastewater to infiltrate. If the soil is not disturbed during harvesting, the permeability will not be affected and wastewater loading can be maintained. The nutrient status of the soil has improved with wastewater application. The increased nutrient availability also resulted in significant increases in vegetation growth. Renovation of wastewater constituents meets applicable standards for each of the three categories of assimilation pathways: biological degradation and/or plant uptake, accumulation in the soil, and leaching of mobile and nondegradable compounds. (Baker-IVI)
W86-01464

EFFECT OF REACTOR TURBULENCE ON THE BINDING-PROTEIN-MEDIATED ASPARTATE TRANSPORT SYSTEM IN THIN WASTEWATER BIOFILMS,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
T. T. Eighmy, and P. L. Bishop.
Applied and Environmental Microbiology, Vol. 50, No. 1, p 120-124, July, 1985. 3 Fig, 1 Tab, 38 Ref.

Descriptors: *Biological wastewater treatment, *Reactor turbulence, *Biofilms, *Aspartate, Shear stress, Bacteria, Turbulence, Transport systems.

This research documents an effect of reactor turbulence on the ability of gram-negative wastewater biofilm bacteria to actively transport L-aspartate via a binding-protein-mediated transport system. Biofilms which were not preadapted to turbulence and which possessed two separate and distinct aspartate transport systems (systems 1 and 2) were subjected to a turbulent flow condition in a hydrodynamically defined closed-loop reactor system. A shear stress treatment of 3.1 N /sq m for 10 min at a turbulent Reynolds number (Re = 11,297) inactivated the low-affinity, high-capacity binding-protein-mediated transport system (system 2) and resolved the high-affinity, low-capacity membrane-bound proton symport system (system 1). The Kt and Vmax values for the resolved system were statistically similar to Kt and Vmax values for system 1 when system 2 was inactivated either by osmotic shock or arsenate, two treatments which are known to inactivate binding-protein-mediated transport systems. It is hypothesized that shear stress disrupts system 2 by deforming the outer membranes of the firmly adhered gram-negative bacteria. (Author's abstract)
W86-01482

MATHEMATICAL SIMULATION OF A BIOFILM PROCESS,
Auburn Univ., AL. Dept. of Civil Engineering.
L. Benefield, and F. Molz.
Biotechnology and Bioengineering, Vol. 27, No. 7, p 921-931, July, 1985. 12 Fig, 1 Tab, 32 Ref.

Descriptors: *Biological wastewater treatment, *Biofilms, *Mathematical models, Simulation, Fixed-film process, Diffusion, Oxygen, Organic compounds, Differential equations.

A mathematical model has been developed for a fixed-film biological process (film flow over a flat plate) that describes bulk liquid transport, diffusional transport of oxygen and organics across a stagnant film, diffusional transport of oxygen and organics into the biofilm, biochemical reactions by the individual cells within the biofilm, biofilm growth, and cell density changes within the biofilm due to cellular decay. The model consists of two partial differential equations and three ordinary differential equations. It was assumed for model development that a lack of either organics or oxygen, or both simultaneously could limit the rate of the metabolic reactions. The two sets of differential equations are themselves coupled by a mass balance around the diffusion layer. The response of the model is illustrated through a numerical solution to the system of five differential equations using specified parameter values. The model illustrates how loading, contact time, biofilm thickness, diffusion layer thickness, and oxygen concentration interact to effect organics removal in a fixed film process. Although the model is developed specifically for film flow over a flat plate, the general system response (in a qualitative sense) due to changes in contact time and diffusion layer thickness will be similar for any film flow biofilm process. (Moore-IVI)
W86-01484

TRAINING: THE BRIDGE BETWEEN TREATMENT AND TECHNOLOGY,
B. Quinn.
American City and County, Vol. 100, No. 2, p 52-54, February, 1985. 2 Fig.

Descriptors: *Wastewater treatment, *Financial aspects, *Training, Education, Management, Operations, Public information.

Training is essential for wastewater treatment and disposal plant operators in light of more stringent regulations being placed on these facilities. It is critical for all operating personnel to understand what the system is as a whole and what it is designed to accomplish. Job-specific training is also needed in light of the introduction of various advanced technologies in wastewater treatment. Frequently those who find themselves in positions of managers, have risen through the ranks and have not had the advantages incurred through management training programs. This is another area of training which needs to be implemented in many water treatment facilities. With training being such an obvious need, the reason why it is so often lacking comes down to available money. Far too often the public feels its responsibility for funding ends once the construction of a wastewater treatment plant is complete. The public needs to be educated about the importance of protecting its investment. (Baker-IVI)
W86-01489

NEW IDEAS RESHAPING TREATMENT TECHNOLOGIES,
W. T. Lorenz.
American City and County, Vol. 100, No. 2, p 56-58, February, 1985. 1 Fig.

Descriptors: *Wastewater treatment, *Economic aspects, Membrane processes, Computers, Automation, Wastewater treatment facilities, Water reuse, Financing, Management.

Public officials are evaluating innovative and cost-effective technologies, as well as exploring alternative financing methods to meet the ever pressing demands for community wastewater treatment needs. Package wastewater treatment plants have been accepted for years as one solution to sewage treatment problems. Membrane technologies, as part of package treatment plants, are also in greater demand where higher quality effluent is desired, perhaps for recycling or reuse. There is a growing demand for instrumentation and sampling systems for monitoring the compositions and concentrations of substances found in influent resulting from industrial waste streams. Computer based services and software are fast becoming an important part of the water and wastewater treatment industry.

For small treatment plants, the tend is toward onsite microcomputer operations that can reduce staff requirements by as much as 75%. Significant progress in water recycling is now underway, due to improved economics, tighter water supplies and tradeoffs between treating water supplies and recycling. Two major obstacles to this thought are the high costs and the potential health hazards posed by reclaimed water. Many public officials are now realizing the need for a business approach to financing and managing municipal wastewater treatment systems. As that market grows, public officials will have to keep informed of the benefits and it falls of the changing technology in order to make the best decision for the advancement of wastewater treatment projects in their communities. (Baker-IVI)
W86-01490

STUDIES ON THE POLLUTION CONTROL OF THE YA-ER LAKE (IN CHINESE),
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
For primary bibliographic entry see Field 5G.
W86-01513

SEEKING TREATMENT; SEWAGE SOLUTIONS IN SAN DIEGO,
W. P. Deddeh.
Oceans, Vol. 18, No. 4, p 63-64, July-August, 1985.

Descriptors: *Tijuana, *Mexico, *San Diego, *California, *Wastewater treatment, Municipal wastewater, Filtration, Public health, Water reuse, Wastewater renovation.

The problems of sewage spills and ocean disposal methods have caused grave concern among environmentalists, legislators, and government officials about the ecological balance of marine life. San Diego, California has a unique problem caused by the neighboring Mexican city of Tijuana. Lack of adequate sewage collection, treatment and disposal facilities in Tijuana have had a serious impact on Sán Diego's beaches and on the Tijuana River. It is unlikely that the sewage situation in Mexico will improve. Currently, under an agreement between the US and Mexico, San Diego treats 15 million gallons/day (MGD) of Tijuana's raw sewage at the Point Loma plant. The remainder, two MGD, is pumped to an ocean discharge point about three miles south of the border. The Tijuana sewage pipe breaks have forced beach quarantines for 307 days in 1981, 219 days in 1982, and 294 days in 1983. Holding ponds have been established which offer a temporary remedy to the situation. One alternative to the construction of a larger pipeline to the Point Loma plant which seems to have the backing of environmentalists and a number of engineers is one which uses a static screening process and plastic media, roughing filters, developed for industrial wastewater treatment. The screen and filter approach also does away with the need to build costly ocean outfalls for ocean discharge and allows the treated waste water to be used for reclamation projects in agriculture or industry. (Baker-IVI)
W86-01540

CASE STUDY ANALYSIS FOR SEASONAL NITRIFICATION: ECONOMIC EFFICIENCY AND WATER QUALITY PRESERVATION,
Lafayette Coll., Easton, PA. Dept. of Civil Engineering.
R. A. Ferrara, and M. A. Dimino.
Journal of the Water Pollution Control Federation, Vol. 57, No. 7, p 763-769, July, 1985. 5 Fig, 6 Tab, 6 Ref.

Descriptors: *Nitrification, *Economic aspects, *Wastewater treatment, *Water quality control, Seasonal variation, Water treatment facilities.

A case analysis demonstrated the elements of a cost effective wasteload allocation procedure for wastewater discharges. For many advanced wastewater treatment facilities, a single year-round effluent limitation is imposed. That limitation is normally based on maintenance of water quality standards during critical conditions of low waste assimilative capacity in the receiving water. Generally this critical condition occurs less than 1% of the time, and therefore these treatment facilities are required to be designed and operated to provide effluent quality far in excess of that necessary to preserve water quality most of the time. A practical approach for biological treatment systems is to assign seasonally varying effluent limitations. The approach is particularly appropriate for nitrification systems because of decreased rates of nitrification and lower ammonia toxicity in the receiving water during cooler times of the year. A statistically determined winter low flow criterion was proposed as the appropriate analog to the conventional 7 day 10 year low flow. In this case study, the annual operation and maintenance cost savings were substantial. It is recommended that regulatory agencies include these procedures routinely in specifying effluent limitations. Wastewater treatment facilities should be encouraged to reevaluate their methods of operation for innovative ways to minimize the costs of operation while still preserving stream water quality. Any reduction in other advanced treatment requirements that can be technically and economically justified while still preserving receiving water quality standards and uses should also be pursued. (Baker-IVI)
W86-01543

OPERATIONAL DYNAMICS AND CONTROL OF SECONDARY CLARIFIERS,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
T. M. Keinath.
Journal of the Water Pollution Control Federation, Vol. 57, No. 7, p 770-776, July, 1985. 13 Fig, 8 Ref.

Descriptors: *Secondary wastewater treatment, *Clarification, Wastewater treatment, Management, Maintenance, Operation.

Solids inventory control strategies have been described for several secondary clarifier overload situations including thickening overloads, and thickening and clarification overloads. A recycle rate control strategy was shown to be effective for thickening overloads and a certain class of thickening and clarification overloads. Effective solids inventory control for situations in which secondary clarifiers are grossly overloaded with respect to both thickening and clarification can be achieved only by applying a step-feed control strategy. Although the graphical approach was used in this research to illustrate various solids inventory control strategies proposed, many treatment plant operators may consider the approach too tedious. Consequently, the control algorithms described were incorporated in a software package designed to control the activated sludge system. This is available under a software package that also includes a data management and comprehensive total maintenance management program. When using the software, the operator inputs only the current influent and recycle flow rates and the MLSS value. The software analyzes the operational state of the system and specifies the type and extent of control action required, if any. This effectively relieves the tedium of the graphical procedure. (Baker-IVI)
W86-01544

PILOT TESTS OF CHLORINATION FACILITY FOR DISINFECTING SECONDARY EFFLUENT,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
J. Y. C. Huang, R. Warriner, and N. S. N. Ni.
Journal of the Water Pollution Control Federation, Vol. 57, No. 7, p 777-784, July, 1985. 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Secondary wastewater treatment, Wastewater treatment, Water treatment facilities, Chlorination, Model studies, Sulfur dioxide, Economic aspects, Coliform, Bacteria, Water quality control.

A comparison was made of effluent fecal coliform reductions achievable with chlorine application by jet and by conventional diffuser. An initial mixing reactor with an assembly equipped for investigating either jet mixer or diffuser mixer wa
structed, and evaluated with secondary ef
An improved iodometric method involvi
back-titration of TRC with coulometrically
ated iodine was used to determine the c
residuals. The efficiency of chlorination wa
ated based on fecal coliform MPN for
mixing modes and initial chlorine applicatio
ages. Most of the chlorine reduction too
during the initial mixing period of about
onds. Higher reductions occurred with t
than with the diffuser. Lower chlorine resid
an improved initial mixing system will
sulfur dioxide requirements when dechlorin
required. Although most of the coliform re
took place during the initial mixing period,
cant coliform reduction continued for up
minutes after chlorine application. The
mixing intensity seemed to affect only the
kills but not later kills. Based on the data, a
sion model was formulated, which incor
the pertinent variables of inital chlorine dos
chlorine contact time. Because of the data
the model may best be considered an indica
the relative importance of the time and con
tion variables. (Baker-IVI)
W86-01545

**FIELD STUDIES OF THE OVERLAND
PROCESS FOR THE TREATMENT OF
AND PRIMARY TREATED MUNI
WASTEWATER,**
California Univ., Davis. Dept. of Civil En
ing.
R. G. Smith, and E. D. Schroeder.
Journal of the Water Pollution Control Fede
Vol. 57, No. 7, p 785-794, July, 1985. 12
Tab, 22 Ref. EPA contract R807757, and
nia State Water Resources Control Board g
196-41.

Descriptors: *Wastewater treatment, *Ov
flow, *Davis, *California, Land disposal, M
pal wastewater, Temperature effects, Precip

A field study was conducted at the city of
California overland flow treatment site. The
system comprised an area of 65 ha and was d
into 15 zones. Each zone consisted of one
opposite facing slopes fed by a central doub
aluminum pipe, 25.4 cm in diameter. Each
was 45 m long and 512 m across. All slope
constructed with a down-slope grade of 2%
cross slope grade of 0.2%. Studies were con
with raw wastewater and primary effluent
termine the relationships between overlan
process performance and the parameters a
tion rate and application period. The effe
precipitation and temperature on process pe
ance were also monitored. Model studies ba
slope length and application rate lead to
tions of smaller land requirements than c
design guidelines have imposed. (Baker-IVI)
W86-01546

**RESPONSE OF PHENOL-ACCLIMATED
VATED SLUDGE PROCESS TO QUAN
TIVE SHOCK LOADING,**
Delaware Univ., Newark. Dept. of Civil Eng
ing.
A. F. Rozich, and A. F. Gaudy.
Journal of the Water Pollution Control Fede
Vol. 57, No. 7, p 795-804, July, 1985. 9 Fig,
32 Ref.

Descriptors: *Wastewater treatment, *Act
sludge process, *Phenols, Kinetics, Shock
Biological wastewater treatment.

Predictions of system response to quant
shock loads, using kinetic model equations
mended for activated sludge treatment of
wastes, do not accurately depict changes in
S in the reactor. A similar situation exists
predictive equations for nontoxic substrat
both cases, certain discrepancies between pre
and observed response occur. These experi
findings support previous recommendation
design and operation of activated sludge sy
for treatment of toxic wastes. Laboratory s

performed to evaluate the biokinetic con-
nd a critical point analysis should be per-
to determine the limits of the allowable
g range. It appears from this work that
s should design for slow specific growth
ien treating toxic substrates. This appears
ven more critical for systems subject to
tive shock loadings. It seems very impor-
, in addition to providing for slow specific
rates, equalization basins to attenuate
in the concentration of substrate in inflow-
to a biological reactor and in flow be
. While phenol can be considered a typi-
itory substrate, work on other carbon
would be a welcome addition to the data
ker-IVI)
47

CTERIZATION OF THE SIZE DISTRI-
OF CONTAMINANTS IN
VATER: TREATMENT AND REUSE
ATIONS,
te Univ., Ames. Dept. of Civil Engineer-

vine, G. Tchobanoglous, and T. Asano.
f the Water Pollution Control Federation,
No. 7, p 805-816, July, 1985. 16 Fig, 7
ef.

rs: *Wastewater treatment, *Pollutants,
ize, Size distribution, Organic matter,
se, Wastewater facilities.

s and sizes of the organic matter in
r and their relationship to treatment are
along with techniques for characterizing
ze distributions in wastewater, the im-
eatment on particle size distribution, and
ations of particle size in evaluating and
treatment and reuse facilities. The organ-
inants in municipal wastewater can be
classified as either greater than or less
icro-m. The size of the organic particu-
in settled municipal wastewater ranges
t 0.1 to 50 micro-m. The molecular size
contaminants smaller than 0.1 micro-m
m less than 10 to the 3rd to about 10 to
ower amu. The percentage of organic
rger than 0.1 micro-m in settled munici-
ater ranges from 30 to 85%. The specif-
age will depend on the nature of the
, the length and flow regime in the
ether influent pumping or grit removal
l on the design and operating character-
e primary sedimentation facilities. The
nt removal mechanisms of most process-
tment of wastewater contaminants are
particle size. Appropriate technology
d to tailor the size distribution of con-
to meet specific treatment objectives.
oration of size distribution analyses into
process will result in the development
novative and cost-effective treatment
r wastewater treatment and reuse. The
design, and operation of wastewater
acilities can be improved by using a
edure that incorporates the concept of
management. (Baker-IVI)

LUDGE STABILIZATION USING
BILIZATION,
at Austin. Dept. of Civil Engineering.
, J. H. Martin, and E. F. Neuhauser.
he Water Pollution Control Federation,
. 7, p 817-826, July, 1985. 7 Fig, 13
NSF grant ISP-8016764.

*Sludge stabilization, *Earthworms,
lization, Municipal waste, Sludge,
treatment, Liquid sludge, Activated

s to identify fundamental factors that
erformance of the vermistabilization
applied studies to determine design
ment relationships were conducted.
are a key component of the liquid
istabilization (LSVS) process. Control
t did not contain worms failed in a
r period of time than did the reactors
with the worms. The LSVS reactors that were not overloaded functioned successfully for 140 to 198 days and were stopped only because the project ended. Oxidized nitrogen (nitrates) in the drainage from the LSVS reactors indicates that aerobic conditions were being maintained. Liquid primary sludge and liquid wastes activated sludge can be stabilized by the LSVS process. LSVS reactors were not adversely affected by short term, large variations in loading rates. Liquid primary sludge was stabilized to about the same degree as liquid aerobically digested sludge in the LSVS process. Moisture balances indicated an overall moisture loss of 4 to 20%. Loading rates of about 21000 g/sq m/week volatile solids or less resulted in satisfactory operation of LSVS reactors stabilizing liquid primary and liquid waste activated sludge. Loading rates greater than 1200 g/sq m/week volatile solids can be used for LSVS reactors stabilizing liquid aerobically digested sludge. With LSVS reactors, the disposal of residual stabilized solids occurs at long intervals. The total solids content of the stabilized residual solids in the LSVS reactors was from 14 to 24%, a considerable increase from the 0.6 to 1.3% that was added. LSVS is a successful process for both dewatering and stabilization. The stabilized residual solids had approximately the same characteristics regardless of the type of liquid sludge added to the reactors. Size and cost estimates indicate that LSVS may be an economically feasible sludge management process. (Baker-IVI)
W86-01549

INFLUENCE OF TRANSIENT PHENOMENA ON THE BIODEGRADATION OF NITRILOTRIACETIC ACID IN THE ACTIVATED SLUDGE PROCESS I: VARIATIONS IN HYDRAULIC LOADING AND SEWAGE STRENGTH,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
M. Hunter, T. Stephenson, J. N. Lester, and R. Perry.
Water, Air, and Soil Pollution, Vol. 25, No. 4, p 415-430, August, 1985. 6 Fig, 2 Tab, 56 Ref.

Descriptors: *Nitrilotriacetic acid, *Activated sludge process, *Biodegradation, Hydraulic load, Chemical oxygen demand, Temperature effects, Detergent builders.

The removal of nitrilotriacetic acid (NTA) following acclimatization in an activated sludge pilot plant has been studied during transient changes in operating conditions. These changes included increases in hydraulic loading and influent chemical oxygen demand (COD) and such phenomena in combination with transient temperature reductions. Short-term increases in hydraulic loading from 1 to 2 dry weather flow (dwf) had a very limited effect on NTA removal. Increasing the influent COD had a slight effect on NTA removal. Short term increases in hydraulic loading combined with transient reductions in temperature significantly reduced NTA removal. The effect of these combined changes on NTA removal was synergistic, rather than additive. Increases in influent COD combined with transient temperature reductions also caused a significant reduction of NTA removal. The effect of such combined changes on NTA removal was at most only additive. (Author's abstract)
W86-01609

INFLUENCE OF TRANSIENT PHENOMENA ON THE BIODEGRADATION OF NITRILOTRIACETIC ACID IN THE ACTIVATED SLUDGE PROCESS II. VARIATIONS IN INFLUENT METAL AND NTA CONCENTRATIONS,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
T. Stephenson, R. Perry, and J. N. Lester.
Water, Air, and Soil Pollution, Vol. 25, No. 4, p 431-450, August, 1985. 9 Fig, 5 Tab, 56 Ref.

Descriptors: *Nitrilotriacetic acid, *Activated sludge process, *Biodegradation, *Metals, Wastewater treatment, Cadmium, Chromium, Copper, Lead, Nickel, Zinc, Detergent builders, Temperature effects.

The removal of Cd, Cr, Cu, Pb, Ni, and Zn in an activated sludge pilot plant acclimatized to nitrilotriacetic acid (NTA) has been compared with an identically operated plant receiving no NTA. During steady-state operation the removal of Pb and Ni was reduced in the presence of NTA but there was no detectable difference in mixed liquor metal concentrations. Transient changes in the influent metal concentration of an order of magnitude had only a slight influence on NTA removal; Ni had the greatest effect, Cd and Cu some effect and Pb a negligible effect. Short term variations in influent NTA concentrations had no effect on NTA removal. A transient increase in influent NTA concentrations caused a slight decrease in NTA removal. Transient increases in influent Ni concentrations combined with reductions in temperature to 10 and 7.5 C had a slight adverse effect on NTA removal. This effect did not appear to be additive or synergistic. Combinations of transient increases in influent NTA concentration and reductions in temperature caused a significant decrease in NTA removal. The effect was synergistic rather than additive. (Author's abstract)
W86-01610

NEW FIELD OF APPLICATION FOR THE ANAMET PROCESS FOR THE PURIFICATION OF INDUSTRIAL WASTEWATER (NEUE ANWENDUNGSGEBIETE DES ANAMET-VERFAHRENS FUR DIE REINIGUNG VON INDUSTRIE-ABWASSERN),
AC Biotechnics A.B., Arloev (Sweden).
B. Hallin.
Chemie-Ingenieur-Technik, Vol. 57, No. 5, p 458-460, May, 1985. 1 Fig, 2 Tab.

Descriptors: *Pulp and paper industry, *Wastewater treatment, *Anamet Process, Industrial wastewater, Pulp wastes, Anaerobic digestion.

The Anamet Process is a anaerobic-aerobic process that was originally developed for the treatment of sugar production wastewater. The newest and most promising application of the Anamet Process concerns the cellulose and paper industry. In general, these wastewaters are more difficult to treat that the wastewaters from the food processing industry. Pilot plant studies were carried out to determine the treatability of cellulose and paper industry wastewaters using the Anamet Process. The first large scale application of the Anamet Process for the treatment of paper mill wastewaters indicates that these wastewaters are treatable using anaerobic methods. (Moore-IVI)
W86-01613

INDUSTRIAL EFFLUENT, HOW TO MINIMISE THE FAILURE,
B. Sidebottom.
Water and Waste Treatment, Vol. 28, No. 6, p 50-52, June, 1985. 3 Fig.

Descriptors: *Wastewater treatment, *Industrial wastewater, Economic aspects, Food-processing industry, Pharmaceutical industry.

Industries where the need to handle liquid waste products is an important, but secondary unproductive and undesirable cost, are considered. These industries include food, pharmaceuticals and manufacturing plants where some chemical process is involved. The first requirement is for the manufacturer to identify and estimate the volume of the waste and the chemical and physical characteristics of its components. The most positive and productive step is to eliminate the creation of waste or pollution products. Consideration is given to the design of the effluent system, commissioning of the plant, and project management and coordination. (Baker-IVI)
W86-01634

INVESTIGATION INTO THE OCCURRENCE OF SEWAGE FUNGUS IN RIVERS CONTAINING PAPERMILL EFFLUENTS - I; REVIEW OF PREVIOUS RESEARCH,
Pira, Leatherhead (England). Paper and Board Div.

For primary bibliographic entry see Field 5C.
W86-01635

INVESTIGATION INTO THE OCCURRENCE OF SEWAGE FUNGUS IN RIVERS CONTAINING PAPERMILL EFFLUENTS - II; CHEMICAL ANALYSIS OF MILL EFFLUENTS,
Pira, Leatherhead (England). Paper and Board Div.
For primary bibliographic entry see Field 5C.
W86-01636

INVESTIGATION INTO THE OCCURRENCE OF SEWAGE FUNGUS IN RIVERS CONTAINING PAPERMILL EFFLUENTS - III; REMOVAL OF SEWAGE FUNGUS-NUTRIENTS,
Pira, Leatherhead (England). Paper and Board Div.
L. J. Webb.
Water Research, Vol. 19, No. 8, p 961-967, 1985. 6 Fig, 4 Tab, 8 Ref.

Descriptors: *Paper wastes, *Wastewater treatment, *Pulp and paper industry, Biological filtration, Activated sludge process, Filtration, Hydrogen peroxide, Glucose.

Pilot scale trials were carried out at two papermills to assess various treatment systems for removal of BOD and effluents: biological filtration through plastic media, activated sludge, multi-media mechanical filtration and hydrogen peroxide addition. Despite some operating difficulties in both cases, activated sludge treatment and biological filtration are capable of substantial reductions in the concentrations of both BOD and sewage fungus nutrients. Mechanical filtration through graded media had no controlling effect on sewage fungus growth produced by clarified or activated sludge effluents; in the case of the primary clarified effluent, some increase in the concentration of glucose (a proven sewage fungus nutrient at this mill) was observed on filtration. On both a laboratory and pilot scale, treatment of clarified effluent with hydrogen peroxide plus ferrous sulfate reduced glucose levels substantially, but the effect on sewage fungus in experimental channels was less clear due to a low level of growth produced at this time by the control, untreated clarified effluent. (Moore-IVI)
W86-01637

CONTROL OF ACTIVATED SLUDGE FILAMENTOUS BULKING - VI; FORMULATION OF BASIC PRINCIPLES,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
J. Chudoba.
Water Research, Vol. 19, No. 8, p 1017-1022, 1985. 6 Fig, 1 Tab, 48 Ref.

Descriptors: *Bulking sludge, *Activated sludge process, Wastewater treatment, Microorganisms, Bacteria, Biological wastewater treatment, Dissolved oxygen.

Extensive research has been conducted concerning filamentous bulking during the past 20 years in numerous countries. A detailed analysis of these findings enables basic principles to be formulated for controlling filamentous bulking. Filamentous microorganisms are present in any activated sludge. Bulking problems appear when the filaments overgrow the floc-formers. Overgrowing of filamentous microorganisms in activated sludge is affected by composition of treated waste water, actual concentration of dissolved oxygen in an aeration tank, actual concentration of soluble substrate under which microorganisms grow, and technological parameters of the process. The microorganism which accumulates most of the amount of substrate in the selector or in an inlet part of the aeration system will be dominant in this system provided the regeneration period for exhaustion of all the accumulated substrate is sufficient. In the aeration system without separate sludge regeneration, all microorganisms have their accumulation capacities fully restored only at low sludge loadings. Filamentous microorganisms in activated sludge are slow-growers. Floc-forming microorganisms in activated sludge are fast-growers. (Baker-IVI)
W86-01643

USING THE SEWERAGE SYSTEM MAIN CONDUITS FOR BIOLOGICAL TREATMENT; GREATER TEL-AVIV AS A CONCEPTUAL MODEL,
Technion - Israel Inst. of Tech., Haifa. Dept. of Environmental and Water Resources Engineering.
M. Green, G. Shelef, and A. Messing.
Water Research, Vol. 19, No. 8, p 1023-1028, 1985. 1 Fig, 4 Tab, 8 Ref.

Descriptors: *Biological wastewater treatment, *Sewer systems, Tel Aviv, Israel, Model studies, Plug-flow reactors, Aeration, Construction costs, Corrosion control, Loop system.

The long-sought idea of using main sewerage conduits as a step-fed plug-flow reactor, where biological sludge is introduced at the head of the main pipelines (hence loop system) and where aeration is provided at various points along the loop, was investigated in this paper in a bench-scale physical model using the Greater Tel-Aviv (Dan Region, Israel) sewerage with design population of 1.3 million and flow of 300,000 cu m/day, as a conceptual model. Due to the inherent advantages of a step-fed plug-flow reactor where high substrate concentrations are maintained along most of the length of the reactor, (except for the final section which provides effluent polishing), the viability of the biomass is 3-5.2-fold higher than the one usually encountered in a conventional activated sludge plant, thus substantially increasing its rate and efficiency of organic substrate removal. It has been shown that in the case of Greater Tel-Aviv, replacing the activated sludge conventional treatment plant with the loop system (with only secondary clarifiers to provide the return biological sludge), or alternatively resorting to the loop system instead of doubling an existing overloaded treatment plant, will produce final effluents well below the requirements of 25 mg/l BOD5 and will provide savings of more than 50% in construction costs. An additional advantage of corrosion control along the main conduits thus increasing their longevity is also discussed. (Author's abstract)
W86-01644

MODELING AND EFFICIENCY OF ULTRAVIOLET DISINFECTION SYSTEMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
R. G. Qualls, and J. D. Johnson.
Water Research, Vol. 19, No. 8, p 1039-1046, 1985. 6 Fig, 3 Tab, 24 Ref. EPA grant R80470010, NSF grant CEE82-05274.

Descriptors: *Model studies, *Ultraviolet radiation, *Disinfection, *Wastewater treatment, Bacteria, Dispersion, Efficiency, Ultraviolet disinfection.

Disinfection of wastewater effluents with ultraviolet (u.v.) light has recently become a rapidly growing alternative to chlorination, but there have been difficulties in measuring u.v. dose. A model is presented which predicts bacterial survival in flow-through systems. The calculation takes into account the complex intensity patterns, non-ideal flow patterns, and non-linear curves of log survival vs u.v. dose. Based on the organismal dose-response, the number of survivors in each fraction of the residence time distribution is calculated separately and summed to calculate the average survival. The model uses as input data the average u.v. intensity within the system, the residence time distribution, and an experimentally determined dose-survival curve in a simplified system where dose can be directly measured. The predictions of the model corresponded well with measured survival in a u.v. pilot plant study. The model was used to show the effects of flow dispersion on average survival by varying residence time distribution. Measures of capacity and efficiency of u.v. systems were derived and illustrated experimentally in simple cylindrical batch units and in two multiple lamp units. Model calculations can be a useful tool for research and development of reactor design. (Moore-IVI)
W86-01647

NITROGEN TRANSFORMATIONS AND OF OTHER PARAMETERS IN COLU DENITRIFICATION,
Windsor Univ. (Ontario). Dept. of Civil En ing.
N. Biswas, and R. G. Warnock.
Water Research, Vol. 19, No. 8, p 1065-107 4 Fig, 6 Tab, 28 Ref.

Descriptors: *Columnar denitrif *Wastewater treatment, *Denitrification, N Organic carbon, Domestic wastes, Nitroge linity, Attached growth system.

Septic tanks followed by some type of sub disposal system have been a common me wastewater disposal for small communities as individual homes for many years. N present in wastewater in the form of amm often oxidized to nitrate and causes serious water contamination. A laboratory study w ducted using kitchen waste as the source of ic carbon for denitrification in an attached system. Kitchen waste is readily available and is inexpensive. Soil columns were denitrifying reactors in the laboratory wh fed solutions were composed of nitrified and kitchen waste. Five different carb pressed as methanol) to nitrogen ratios from 2:2 to 6:1 were applied to twenty s umns. A high degree of denitrification tained for C:N ratios of 4:1 or higher. application was not a significant factor. the TKN present in the feed solutions esca denitrification reactors. The production alkalinity during denitrification was so lower than the values reported in the lit Biological cells were washed out regularl the soil column and results show that i cases the column effluents contained highe concentrations than the influent. (Moore-IV
W86-01650

TURN KEY APPROACH TO CLEAN W IN ALABAMA,
Harmon Engineering and Testing, Aubur
G. R. Harmon.
Current Municipal Problems, Vol. 11, N 498-503, Spring, 1985. 18 Ref.

Descriptors: *Water pollution *Wastewater treatment, *Alabama, * Clean Water Act, Economic aspects, Privat

Recent policy statements of the Enviro Protection Agency have directed that m wastewater treatment plants will be in com with the Clean Water Act, regardless of th ability of Federal monies. Public/private ships are emerging nationwide as the answe financial dilemma facing many local gover The entry of private business into the prov municipal services is not a new concept. palities are finding that private sector finan the privatization approach, allows them to cost efficient wastewater treatment with hausting their budget funds and/or borrow pability to provide the services. Private firms are showing a keen interest in fundi subsequently owning and operating, was treatment and other traditionally public f on a turn key basis. Privatization permits th governments to meet discharge limits, and same time, control costs. The investor, too privatization to be an attractive and profitab ture. A specific example of privatization, A Alabama, is cited as an example of a plan working. (Baker-IVI)
W86-01687

REDUCTIVE DECHLORINATION OF PESTICIDES 2,4-D, 2,4,5-T, AND PEN LOROPHENOL IN ANAEROBIC SLUDG
Michigan State Univ., East Lansing. Dept. and Soil Sciences.
M. D. Mikesell, and S. A. Boyd.
Journal of Environmental Quality, Vol. 14,

0, 1985. 4 Fig, 1 Tab, 14 Ref. Dep. of Air
ntract F08635-83-C-0290.

ors: *Dechlorination, *Reduction, *Deg-
*Pesticides, *Dichlorophenoxy acetic
ichlorophenoxy acetic acid, *Pentachlor-
*Trichlorophenol, *Chlorophenols, *An-
reatment, Fate of pollutants, Herbicides,
ed hydrocarbons, Halogenated hydrocar-
stewater treatment.

radation of seven chlorinated aromatic
ds in anaerobic sewage sludge from three
communities was examined. The com-
ested were 2,4-D (2,4-dichlorophenoxy
d), 2,4,5-T (2,4,5-trichlorophenoxy acetic
P (penta-chlorophenol), 2,4,6-trichloro-
nd 2-, 3-, and 4-chlorophenol. All of the
ds tested were degraded in one or more
dges during a 70-d incubation period.
-chlorophenol was the most persistent
l tested followed by 3-chlorophenol. The
l degradative reactions were cleavage of
linkage of the phenoxy acetic acid herbi-
D, and 2,4,5-T, and the removal of Cl
ho to the phenolic OH group of the
nols. The initial products of 2,4-D and
egradation were 4-chlorophenol and
lorophenol. Reductive dechlorination of
orophenol (produced from 2,4,5-T) gave
ophenol and 4-chlorophenol which
final products of 2,4,5-T degradation.
tion of PCP gave 3,4,5-trichlorophenol
al transformation product, and further
tion gave 3,5-dichlorophenol as final
PCP degradation. The Jackson sludge
reatest capacity to degrade the com-
ted. With the exception of 3- and 4-
ol, all other compounds tested were
degraded in 7 to 14 d in the Jackson
son and Adrian sludges were similar in
dative pathways overall, but significant-
ve than the Jackson sludge. (Author's

**ANCE OF EXPANDED-BED METH-
C REACTOR,**
v. at Urbana-Champaign. Dept. of Civil
.
, M. T. Suidan, and B. E. Rittmann.
Environmental Engineering, Vol. 111,
0-471, August, 1985. 9 Fig, 3 Tab, 16
PA contract EPA R-809750-01.

*Expanded-bed reactors, *Methano-
astewater treatment, *Anaerobic diges-
ical treatment, Fluidized bed process,
nent.

ed-bed reactor can achieve high organ-
ercentages at low temperatures, even
g low strength waste at short liquid
nes. A completely mixed, expanded-
ic granular activated carbon reactor
ted continuously on synthetic
in which acetate was the only organic
e. Acetic acid was used as the sub-
se it is the major metabolic product
rmentation of organic matter. During
continuous operation, steady-state per-
s achieved for four influent acetate
s: 800, 1,600, 3,200, and 6,400 mg/L.
removal efficiencies of acetate, COD
ceeded 98, 97, and 98%, respectively.
f the study period, 99.6% of the feed
onverted to methane gas, suggesting
l utilization was the major removal
r acetate in the expanded bed reactor
net growth of methanogens was very
oduction from the reactor doubled
ediately after sudden doubling of the
while the aqueous phase concentra-
increase drastically. The completely
ded-bed GAC reactor may be used to
l effluent quality from low-strength
strength wastewaters. (Collier-IVI)

**ING OF ANAEROBICALLY DI-
JDGE,**

Camp, Dresser and McKee, Inc., Raleigh, NC.
For primary bibliographic entry see Field 5E.
W86-01728

RUSSIAN USE OF FLOTATION FOR WASTEWATER TREATMENT,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
N. Myasnikov, L. V. Gandurina, and L. N. Butseva.
Effluent and Water Treatment Journal, Vol. 25, No. 6, p 202-206, June, 1985. 4 Fig, 4 Ref.

Descriptors: *Wastewater treatment, *Flotation, Sediments, Petroleum products, Oil, Fats, Surfactants, Water treatment, Physical properties, Chemical properties, Activated sludge.

Schemes and techniques being used in Russia for oils, fats, petroleum products and surfactants removal from wastewaters by flotation are reviewed. The following kinds of flotation are being used at present for treatment of sediments and activated sludges: compression (pressure), impeller, vacuum, biological, chemical, electric and ionic flotation, froth separation. For the sake of further development of methods and structures of flotation plants for wastewater purification and sediment treatment, attention should be paid to the following aspects: increase in operating efficiency of devices for dissolving air and gas in liquid; providing optimum conditions of flotation separation of gas and liquid medium; studying hydrodynamic conditions of frother cells; studying physical and chemical properties of water air medium; creating reagents for floation treatment of wastewater and compaction of sediments and activated sludges; studying flotation process accompanied by sorption, adsorption, and oxidation; designing combined installations; studying the pecularities of flotation treatment of wastewater and final treatment of biologically purified water with activated sludge compaction; designing devices for froth removal, its processing and reclaiming of valuable components; designing automatized flotation plants; and generalizing the operational results of flotation plants and their technical and economic evaluation. (Baker-IVI)
W86-01736

CURRENT STATUS OF DENVER'S POTABLE WATER REUSE PROJECT,
Denver Water Dept., CO.
For primary bibliographic entry see Field 3B.
W86-01742

RECLAIMING DESERT LANDS THROUGH WATER REUSE,
Goff Consulting and Engineering Corp., Chandler, AZ.
J. D. Goff, and P. L. Busch.
Journal of American Water Works Association, p. 84-87, July, 1985. 1 Fig, 4 Tab.

Descriptors: *Water reuse, *Land reclamation, Deserts, Urban areas, Municipal wastewater, Wastewater treatment facilities, Urban areas, Chandler, Arizona.

The city of Chandler, Arizona, has implemented a program for total reuse of its municipal wastewater effluent. The municipal water system is supplied from groundwater sources that are being pumped at a rate far in excess of the rate of recharge. To meet the total future water supply needs, reuse of municipal wastewater is essential. A new reclamation facility will serve as the cornerstone of the city's program, which has several unique aspects. The new wastewater treatment facility will be sited where there is no adjacent watercourse, thus necessitating complete reuse of its effluent. Financing, ownership, and operation of the facility are being done through privatization. The reuse system has been developed through a public-private partnership between the city and landowners whose property borders the facility. The facilities will include an effluent pipeline and an artificial lake system, to be surrounded by a golf course, greenbelt area, and areas designated for residential and commericial development. (Moore-IVI)
W86-01746

BACTERIAL ADHESION AND FOULING OF REVERSE OSMOSIS MEMBRANES,
Orange County Water District, Fountain Valley, CA. Water Factory 21.
H. F. Ridgway, M. G. Rigby, and D. G. Argo.
Journal of the American Water Works Association, p 97-106, July, 1985. 16 Fig, 36 Ref.

Descriptors: *Wastewater renovation, *Reverse osmosis, *Membrane processes, *Bacteria, Biofouling, Mycobacterium, Escherichia, Acinetobacter, Cellulose acetate, Hydrophobic interaction.

Adhesion of selected bacteria to cellulose actetate (CA) reverse osmosis (RO) membranes used in wastewater reclamation processes was investigated to determine its role in membrane fouling and reduces process efficiency. Adhesion of a Mycobacterium sp. previously isolated from an early stage of RO membrane biofouling was relatively unaffected by large variations in the ionic strength or pH of the buffer system. However, trace quantities of a polyoxyethylene ether nonionic detergent almost completely inhibited attachment. The mycobacteria were found to adhere to the CA membrane surface (or to a CA-affinity column) approximately 25-fold more effectively than a wild-type strain of Escherichia coli. The ability of Mycobacterium and E. coli to adhere to the membrane was correlated with their relative surface hydrophobicities as determined by their affinities for n-hexadecane. A similar correlation was established between a hydrophilic wild-type strain of Acinetobacter phosphadevorus containing a single 17.8 mega-Dalton plasmid (PYG1) and a more hydrophobic isogenic derivative strain (P7P-) lacking the PYG1 plasmid. Unlike the P7WT parent strain, the P7P- derivative produced more fimbrialike appendages, which may account for its enhanced hydrophobic and adhesive properties. The results suggest that hydrophobic interactions between bacterial cell surface components and the CA membrane surface play an important role in the initial stages of bacterial adhesion and RO membrane biofilm formation. (Author's abstract)
W86-01748

EFFECTS OF SEWAGE EFFLUENT ON ENDOMYCORRHIZAL DEVELOPMENT IN ACER,
Michigan Univ., Ann Arbor. School of Natural Resources.
P. C. Otto, and J. R. Boyle.
Canadian Journal of Forest Research, Vol. 14, No. 2, p 246-249, April, 1984. 3 Fig, 5 Tab, 21 Ref.

Descriptors: *Wastewater irrigation, *Maple trees, *Endomycorrhizae, Phosphorus removal, Nitrogen removal, Wastewater renovation, Forests, Michigan.

Application of stabilized sewage effluent on forested sites has proved an effective means of removing phosphorus and nitrogen which could otherwise cause overabundant growth in lakes and streams. The effects of such applications on mycorrhizal association must be included in a complete evaluation of the effects of sewage effluent application to hardwood forest sites. Secondarily treated sewage effluent was sprayed into a 50-year-old beech-maple forest near Harbor Springs, Emmet County, Michigan. Effluent was applied at rates of 0, 3.8, and 7.6 cm per week onto thinned and unthinned plots during the growing seasons of 1978 and 1979. Each spray rate and density combination was replicated four times. Acer sp. roots were examined each growing season to evaluate development of endomycorrhizae. Numbers of mycorrhizae were significantly greater in the sprayed than in the unsprayed plots but did not vary significantly with month of thinning. Nutrient additions and increased water availability may have contributed to the mycorrhizal increases at this site. The endomycorrhizal increases observed on this study site further indicate the suitability of these hardwood sites for use in wastewater renovation. (Moore-IVI)
W86-01778

CALCULATION OF OXYGEN CONSUMPTION AND AMOUNT OF EXCESS ACTIVATED SLUDGE IN MULTISTAGE AERATION TANKS,
Kievskii Tekhnologicheskii Inst. Pischevoi Promyshlennosti (USSR).
S. P. Tsygankov.
Water Resources, Vol. 11, No. 4, p 386-390, July-August, 1984. 1 Fig, 1 Tab, 9 Ref. Translated from Vodnye Resursy, No. 4, p 139-143, July-August, 1984.

Descriptors: *Biological wastewater treatment, *Activated sludge process, *Oxygen consumption, *Aeration tanks, Sludge, Mathematical equations, Energy, Wastewater treatment.

Taking into account the energy consumption of the process of biological treatment, which increases with increasing pollution of wastewaters, it is quite important to select the most economical multistage systems. Economy is determined mainly by oxygen consumption and the amount of activated sludge formed, the utilization of which requires certain expenditures. Methods of calculation are developed which are suitable for optimization of sectional or multistage aeration tanks with respect to oxygen expenditures and formation of excess activated sludge. A schematic diagram is presented of the flows of the aeration tank-mixer and secondary sedimentation tank. The conventional assumptions are introduced that processes of an increase of biomass and utilization of the substrate do not occur in the sedimentation tank and there is no activated sludge biomass in the clarified liquid leaving the sedimentation tank. Despite the smaller consumption of the substrate in the second stage, the oxygen requirement is higher owing to oxidation of the incoming activated sludge biomass. The specific consumption of oxygen for treatment increases with decrease of the specific rate of increase of biomass. The latter depends on the flow rate of the biomass entering the aeration tank from the secondary sedimentation tank or from the preceding aeration tank. The specific oxygen consumption and productivity of the aeration tank with respect to biomass are inversely related. The equation obtained can be used for optimization calculations of the stoichiometry of single- and multistage aeration tanks. (Baker-IVI)
W86-01814

ROLE OF MACROPHYTES IN REMOVING ALIPHATIC AMINES FROM WATER,
Irkutskii Gosudarstvennyi Univ. (USSR). Biological and Geographical Research Inst.
S. S. Timofeeva, and O. A. Men'shikova.
Water Resources, Vol. 11, No. 3, p 240-244, May-June, 1984. 4 Fig, 10 Ref. Translated from Vodnye Resursy, No. 3, p 109-113, May-June, 1984.

Descriptors: *Water treatment, *Macrophytes, *Methylamine, Aliphatic hydrocarbons, Organic matter, Aquatic plants, Waterweed, Biological wastewater treatment.

The elimination of methylamine from water by a number of macrophytes and possible mechanisms of this process were investigated, and the possible use of macrophytes in wastewater treatment is discussed. Of the various macrophytes investigated, waterweed had the the maximum rate of elimination of methylamine. While it was not possible to make unequivocal conclusions about the mechanism of the elimination process, both the following components most likely made a substantial contribution to the methylamine elimination process: the diffusion entry and accumulation and enzymatic conversion with the participation both of oxidizing enzymes and other enzymes participating in nitrogen metabolism of plants. Waterweed effectively eliminated methylamine, and methylanime was not detected after 2 days following treatment. The successive introduction of methylamine once a week showed that a waterweed biofilter can actively purify water during the entire time of this study, up to 2 months. When the phytomass of waterweed increases, it is necessary to remove it and keep it within the optimal conditions of 5 g/liter. Waterweed can remove aliphatic amines not only of technogenic origin but also those which are formed upon decomposition of phytoplankton and naturally makes a substantial contribution to self-purificaton of water bodies and to water quality. (Baker-IVI)
W86-01823

USE OF MACROPHYTES FOR TREATING AGRICULTURAL RUNOFF,
N. V. Morozov.
Water Resources, Vol. 11, No. 3, p 259-268, May-June, 1984. 3 Fig, 6 Tab, 39 Ref. Translated from Vodnye Resursy, No. 3, p 131-141, May-June, 1984.

Descriptors: *Macrophytes, *Wastewater treatment, *Agricultural runoff, Biological wastewater treatment, Runoff, Agricultural chemicals, Fertilizers, Farming, Aquatic plants.

Measures aimed at protecting waters from surface runoff from cultivated land can be divided into three groups. The first calls for improvement of farming practices. The second includes measures to prevent the inflow of polluted surface and drainage runoff by diverting it into lagoons, stabilization and oxidation ponds, buffer reservoirs, or other holding areas. The third group is aimed at the accumulation and decontamination of the diffuse surface runoff. Biological ponds with their photosynthetic aeration by microalgae and higher aquatic plants have potential application for decontaminating surface waters. The considerable filtering, accumulating, absorbing, and mineralizing ability of macrophytes makes them a powerful factor for biological self-purification of fresh and brackish waters. Duckweed showed maximum activity in extracting nitrate and nitrite nitrogen from the water. The ability of macrophytes to remove fertilizers from water improves in June and July, which is related to the period of active physiological activity of the plants. In these months the content of nitrite nitrogen in experiments with bulrush and cattail decreased by more than tenfold as early as five days after fertilizer application. Experiments with bulrush, narrowleaf cattail, and waterweed showed that waterweed extracts nitrates more than nitrites from wastewaters. The use of higher aquatic plants for treating highly eutrophic waters can be accomplished by introducing them in the littoral zones and mouths of small rivers, in shallows of reservoirs, or in canals, buffer storages, biological ponds or lagoons, specially created for this purpose. (Baker-IVI)
W86-01826

STOICHIOMETRY OF PROCESSES OF AEROBIC BIOCHEMICAL WASTEWATER TREATMENT,
Ministerstvo Sel'skogo Khozyaistva URSR, Kiev. Main Design Inst.
S. P. Tsygankov, O. P. Smirnov, A. N. Dergileva, and T. P. Slyusarenko.
Water Resources, Vol. 11, No. 3, p 268-272, May-June, 1984. 4 Fig, 3 Tab, 9 Ref. Translated from Vodnye Resursy, No. 3, p 142-146, May-June, 1984.

Descriptors: *Wastewater treatment, *Activated sludge process, *Evaluation, *Stochastic process, Aerobic digestion, Mathematical equations, Carbon dioxide, Oxygen, Carbon.

The relationship between the technological parameters of a treatment process and material and energy balance in apparatus consisting of a biochemical reactor (mixer) and biomass sedimentation tank was investigated. The balance of elements was studied during continuous culturing of activated sludge microorganisms on wastewaters of a swine-raising complex in the ANKUM-2 apparatus at a temperature of 20 degrees C. The working volume of the fermenter was 1 and 2 liters, the rotational speed of the stirrer was 500/min with complete oxygen saturation of the fluid. Culturing was carried out at various dilution rates: 0.16, 0.04, and 0.02/hr. The fermenter was connected with the sedimentation tank by a 1 liter vessel, for withdrawing the excess and recirculating biomass for which a peristaltic pump was used. Equations are derived which can be used for evaluating aerobic wastewater treatment systems. (Baker-IVI)
W86-01827

INFLUENCE OF NITRATES ON BIOLO PHOSPHORUS REMOVAL WASTEWATER,
Compagnie Generale des Eaux, Paris (F Anjou Recherche.
M. C. Hascoet, and M. Florentz.
Water S. A., Vol. 11, No. 1, p 1-8, January, Fig, 4 Tab, 13 Ref.

Descriptors: *Nitrates, *Phosphorus remov ological wastewater treatment, Aeration, N magnetic resonance, Aerobic conditions, A bic conditions, Biomass.

A study was carried out to observe the beha orthophosphates under aerated or non-aerat ditions in the presence of nitrates during experiments, the effect of nitrate concentrat mg/l as N) in the influent of a laboratory un to phosphate removal and the evolution o phorus assimilation after stopping nitrate ac Phosphorus nuclear magnetic resonance wa to observed the changes in the different ph rus compounds with time, without disturbi living system. The substrate concentrati pressed as COD must be taken into account as the concentration of nitrates being introd the anaerobic zone. Nitrates, even in high c trations during the aerobic stage do not p good phosphorus uptake by microorganis though they can prevent the formation of an obic phase required for the luxury uptake o phorus. The polyphosphates are not used the non-aerated period because the ATP pr be maintained by the glycolitic metabolis continuous addition of nitrates during th aerated phase modified either the microbial lation or the enzymatic activities, because lease of phosphate is not immediate after st the nitrate addition to the feed, but takes days to occur. This time is necessary to accl the biomass to the alternating anaerobic- phases. (Moore-IVI)
W86-01857

KINETICS AND MECHANISM OF OZ TION OF FREE CYANIDE SPECIE WATER,
Drexel Univ., Philadelphia, PA. Dept. o Engineering.
M. D. Gurol, and W. M. Bremen.
Environmental Science and Technology, V No. 9, p 804-809, 1985. 6 Fig, 1 Tab, 2

Descriptors: *Chemical kinetics, *Ozo *Cyanides, Ozone, Hydrogen ion concent Cyanates, Wastewater treatment, Mass trans

The kinetics and the mechanism of the ozo reaction of free cyanide species were inves in aqueous solution in the pH range 2.5-12 cording to the kinetic results obtained stopped-flow spectrophotometer, the reac first order with respect to ozone, and th increases with increasing pH. The rate sh varying dependence on cyanide concentrat different pH values. The rate constant f direct reaction of molecular ozone with c ion was calculated to be 2600 +/- 700/M/s and bubble-column experiments indicated st metric conversion of cyanide to cyanate ozone consumption of 1.2 +/- 0.2 mol/ oxidized cyanide. Ozonation of cyanide-b wastewaters at high pH is expected to b transfer limited under the operating condit most experimental or full-scale contactor kinetic regime for the process at neutral pH depend upon the mass-transfer characteris the ozone contactors. (Moore-IVI)
W86-01870

LOW-TECH SCORES PAR FOR WATE GOLF COURSE,
Greeley and Hansen Southwest, Phoenix, AZ
W. A. Ambrose.
Consulting Engineer, Vol. 65, No. 3, p 38-3 tember, 1985. 1 Fig.

ors: *Wastewater treatment, *Golf *Water reuse, Irrigation water, Design Water supply development.

e application of basic water reclamation ovided the solution for irrigating the 27 mpionship golf course that is part of anch, a 640 acre, luxury, mixed use resort y under development. There is adequate ter on site for irrigation. For other pur- 1.7 mgd water reclamation plant was as part of the initial design phase of the ent. The objectionable characteristics of e, and unsightliness were overcome by esign adaptations. Public acceptance has eved in direct relationship to the success esign adaptations. Wastewater flows in a fashion through five 20 ft by 116 ft nks. Next, it flows to two 20 ft x 100 ft r clarifiers where sludge and dilute scum ted. The dilute scum flows by gravity sludge is pumped back to the municipal rified water flows to two 9 x 38 ft rapid and then to two ultraviolet disinfection e it is pumped to the reclaimed water From there it subsequently is pumped vel maintenance and golf course irriga- ronmental controls for the plant are sidered. (Baker-IVI)

N OF CARBON AND PHOSPHORUS QUID POULTRY MANURE BY SOIL TES OF DIFFERING SIZE,
iv. (Ontario). Dept. of Land Resource

nagar, and M. H. Miller.
ournal of Soil Science, Vol. 65, p 467- t, 1985. 7 Tab, 12 Ref.

*Carbon, *Phosphorus, *Manure, gates, *Sorption, Particle size, Animal stewater disposal, Particulate matter.

laboratory experiments was conducted e the mechanism(s) responsible for a reported observation that addition of re to soil increased the NaHCO3-ex- (Ext-P) of large aggregates (>2 mm) hat of smaller aggregates whereas addi- organic P solution did not. Application ultry manure increased the total P, Ext- C concentrations in large aggregates uch more (> 2.5x) than that in small (< 1 mm). Addition of inorganic P f supernatant liquid from a centrifuged ry increased the P content of the large nly slightly (1.2x). A greater increase large aggregates was observed even naller aggregates were purposely lay- of the larger ones prior to addition of anure. A similar but less pronounced gregate size on increase in P or C n was observed when different sized ere left in contact with an effectively ce of liquid manure for 24 h. It is hat the larger aggregates absorbed bulk manure slurry than smaller aggre- rtial sealing of small aggregates by is suggested as a possible mechanism. stract)

nate Disposal Of Wastes

ON OF ARTIFICIAL CLAYS IN ROL OF TOXIC POLLUTANTS,
rnational Ltd., London (England).
tt, and E. W. Marwood.
Geology, Vol. 21, No. 3/4, p 267-272, Fig, 3 Tab, 3 Ref.

*Hazardous materials, *Landfills, ay, *Waste disposal, Water pollution odium silicate, Cement, Waste stabili- y metals, Sludge disposal.

for acid leaching is one of the major ncern in the landfilling of heavy metal possible to create barriers against migration around the toxic particles themselves, rather than around a landfill as a whole. The CHEMFIX process starts with a concentrated solution of sodium silicate, which is mixed with the waste. This is in turn mixed with cement. In the final mixture, the cement reacts with the evenly distributed silicate to give a gel around the waste particles that creates the desired barriers to migration. The artificial clay-like solid resulting from the stabilization of toxic waste using the CHEMFIX process has many advantages. The CHEMFIX waste-form, because of its low permeability, high buffer capacity against acid leaching and its clay-like structure and properties, can be used to stabilize heavy metal sludges for landfilling. A simple model is developed and used to investigate the values of the various parameters involved in the product design. The immobilization periods expected for a CHEMFIX wasteform monolith are in excess of current design values for screens and liners. (Moore-IVI)
W86-01456

EFFECT OF LEACHING ON THE INTEGRITY OF A NATURAL CLAY,
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
R. N. Yong, D. S. Elmonayeri, and T. S. Chong.
Engineering Geology, Vol. 21, No. 3/4, p 279-299, June, 1985. 22 Fig, 3 Tab, 17 Ref.

Descriptors: *Leaching, *Clay, *Strength, *Integrity, Liners, Waste ponds, Soil properties, Water pollution prevention, Chemical properties, Boundary conditions, Soil structure.

Clay minerals have long been used as ion-sieving filters, separators, or reinforcing elements to prevent contamination of the domestic groundwater from the transmission of polluted liquids through the bottom and side boundaries of waste holding ponds. Leaching effects on the strength of a natural clay substrate can lead to loss of integrity of pond containment situation, especially if the clay material constitutes the liner system for the containment pond. The integrity of the clay in the face of five different types of leachates is studied via the creep characteristics of the clay. The leachate types include sodium silicate, sodium chloride, sodium acetate, saturated calcium hydroxide solution plus 10 carbon dioxide air, distilled water and a reference natural untreated water sample. The resultant effects are evaluated in terms of soil fabric/structure reinforcement or degradation, and changes in the relationships established between soil particles and chemical pore fluid. The integrity of the clay is severely conditioned by factors producing the initial soil structural state, the chemistry of the leachate, local boundary conditions, and time. (Moore-IVI)
W86-01457

US SLUDGE MANAGEMENT GUIDELINES EXPLAINED,
E. D. Lomnitz.
Water and Water Treatment, Vol. 28, No. 4, p 37, 40, April, 1985.

Descriptors: *Sludge management, *Standards, Management, Planning, Sludge disposal, Wastewater management.

An EPA sludge task force was established in 1982 which was responsible for assessing the magnitude and management approaches to municipal sludge reuse and disposal nationwide, evaluating strengths and weaknesses of past regulatory activities, and identifying data and informational needs in order to direct EPA research in the field. In developing regulations for reuse/disposal options, several key areas need to be considered including the identification of potential pollutants, the magnitude of hazard or risk, levels at which these pollutants cause these risks, the existence of management practices which could reduce the risks, and the relevant risks between the various reuse/disposal options. With the completion of technical support documents, drafting of the proposed regulations can commence. The proposed regulations will clearly delineate the requirements in terms of management practices and numeric standards. The regulations will also contain compliance monitoring requirements. (Baker-IVI)
W86-01461

USE OF AERIAL PHOTOGRAPHY AND IMAGE PROCESSING TO MEASURE DYE DISPERSION FROM A LONG SEA OUTFALL,
Royal Military Coll. of Science, Shrivenham (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W86-01518

MANAGEMENT OF CONTAMINATED DREDGED MATERIAL FROM THE HUDSON RIVER,
Pirnie (Malcolm), Inc., White Plains, NY.
For primary bibliographic entry see Field 5G.
W86-01564

EFFECT OF SEWAGE SLUDGE ON MICROBIAL ACTIVITY IN AN OLD, ABANDONED MINESOIL,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
H. F. Stroo, and E. M. Jencks.
Journal of Environmental Quality, Vol. 14, No. 3, p 301-304, July-September, 1985. 3 Tab, 45 Ref. West Virginia University Mining and Mineral Res. Inst. project MI8050R.

Descriptors: *Sludge, *Water pollution effects, *Land reclamation, *Mining, *Minesoils, *Microbial activity, Enzymes, Amylase activity, Phosphatase activity, Respiration, Urease activity, Fescue, Waste disposal, Land treatment.

The effect of lime, fertilizer, and sewage sludge (50 and 100 kg/ha) upon microbial activity and growth of sparsely distributed tall fescue (Festuca arundinaceae Schreb.) on an old, acidic, infertile sandy loam (Typic Udispolents; loamy-skeletal, mixed, acid, mesic) minesoil was evaluated. Respiration rate and activities of amylase, urease, and phosphatase were used as indices of microbial activity. When compared with the control, lime significantly increased respiration rate, had no effect upon amylase and urease activities, and significantly reduced phosphatase activity. Fertilizer significantly increased respiration rate and amylase activity, but significantly decreased urease activity. Phosphatase activity was not affected by fertilizer applications. Lime plus fertilizer significantly increased respiration rate and amylase activity, had no affect upon phosphatase activity, while it drastically reduced urease activity. Sludge at both rates of application in conjuction with lime and fertilizer (S1LF, S2LF) are only compared with the lime-fertilizer treatment. Both S1LF and S2LF significantly increased respiration rate and urease activity; S2LF was significantly more effective more than S1LF. Amylase activity was significantly increased by both S1LF and S2LF, although there was no difference between the two treatments. The S1LF had no effect upon phosphatase activity, whereas activty, whereas S2LF caused a significant activity increase. All treatments produced significant increases in tall fescue yield. Fertilizer was significantly more effective than lime. The fertilizer and the lime-fertilizer treatments were about equally effective. Both S1LF and S2LF produced yields that were significantly greater than the lime-fertilizer treatment. The S2LF had a significantly greater effect upon yield than did S1LF. (Author's abstract)
W86-01702

CONDITIONING OF ANAEROBICALLY DIGESTED SLUDGE,
Camp, Dresser and McKee, Inc., Raleigh, NC.
A. I. Cole, and P. C. Singer.
Journal of Environmental Engineering, Vol. 111, No. 4, p 501-510, August, 1985. 10 Fig, 1 Tab, 6 Ref.

Descriptors: *Anaerobic digestion, *Sludge conditioning, *Polyelectrolytes, Electrolytes, Biological treatment, Digestion, Polymers, Wastewater treatment.

Synthetic organic polyelectrolytes can be used to condition sludges to enhance their dewaterability. When conditioning biological sludges, the charge on the polymer has a significant impact on the effectiveness of the polymer as a conditioner. The objectives of this investigation were to determine the most effective type of polymer product for conditioning anaerobically digested sludge prior to dewatering, and to investigate how the chemical characteristics of the polymer influence the way it interacts with the sludge particles. Capillary suction time and particle electrophoretic mobility measurements were employed to achieve this objective. The results indicate that cationic polymers with molecular weight in excess of 1,000,000 appear to be required for effective conditioning. However, effective sludge conditioning can be achieved with either high or low charge density cationic polymers and that dosing to achieve charge neutralization of the sludge particles is not a prerequisite for effective sludge conditioning. (Author's abstract)
W86-01728

DESIGN CONSIDERATIONS FOR A NOVEL LANDFILL LINER,
Rutgers - The State Univ., Piscataway, NJ. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W86-01730

5F. Water Treatment and Quality Alteration

FLOCCULATION, PRECIPITATION, SEDIMENTATION AND FLOTATION FOR USE AS PRETREATMENT STAGES FOR BRACKISH WATER AND SEAWATER IN DESALINATION PLANTS,
Hager und Elsaesser G.m.b.H., Stuttgart (Germany, F.R.).
For primary bibliographic entry see Field 3A.
W86-01370

REVERSE OSMOSIS AND ULTRAFILTRATION SOLVE SEPARATION PROBLEMS,
Clemson Univ., SC.
For primary bibliographic entry see Field 5D.
W86-01441

ROLE OF FORMATION AND REDUCTION OF THM AND CHLORITE CONCENTRATIONS IN THE DISINFECTION OF WATER WITH CL2 AND CLO2,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
Ch. Rav-Acha, E. Choshen, A. Serri, and B. Limoni.
Environmental Pollution (Series B), Vol. 10, p 47-60, 1985. 7 Fig, 3 Tab, 22 Ref.

Descriptors: *Disinfection, *Chlorine, *Chlorine dioxide, *Trihalomethanes, *Chlorite, Water treatment, Drinking water, Chlorination, Oxidation, Lake Kinneret, Israel.

Chlorine dioxide is one of the most promising alternatives to chlorine for the disinfection of drinking water. One of the major advantages of chlorine dioxide over chlorine is that it does not produce trihalomethanes (THM); however, chlorine dioxide is reduced mainly to undesirable chlorite. Mixtures of ClO2 and Cl2 may successfully reduce the formation of both THM and chlorite in the absence of bromide. The ClO2 may compete with chlorine for the organic precursors, thus reducing the formation of chlorinated by-products, while the chlorine can, in turn, oxidize the chlorite, which is the main reduction product of chlorine dioxide. When Lake Kinneret water in Israel was studied, however, it was found that such mixtures caused only a minor reduction in the formation of THM compared with chlorine alone. This is probably due to the presence of 2 mg/l bromide in the water of Lake Kinneret. The formation of THM and chlorite may be satisfactorily reduced (by about 60% and 90%, respectively), if chloride dioxide is allowed to react in water with the THM precursors before chlorine is introduced. (Moore-IVI)
W86-01453

WATERBORNE EPIDEMIC OF ACUTE INFECTIOUS NON-BACTERIAL GASTROENTERITIS IN ALBERTA, CANADA,
903 Abbotsford Drive N.E., Calgary, Alberta T2A 5Y3.
For primary bibliographic entry see Field 5C.
W86-01486

IMPROVEMENTS IN TREATMENT PERFORMANCE AT GRAFHAM WATER TREATMENT WORKS: ANGLIAN WATER,
C. Harward.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 3, p 225-230, June, 1985. 4 Fig, 2 Tab, 3 Ref.

Descriptors: *Water treatment facilities, *Grafham Water Treatment Works, *England, *Water treatment, Coagulation, Aeration, Soda ash, Filtration, Sludge.

The effect of modifying the coagulant aid dosing system and other operational changes which resulted in the achievement of the desired increased efficiency at the Grafham Water Treatment Works are reviewed. During the winter of 1983-84 a prolonged increase in demand for water at a time of low water temperatures (3-6 C) resulted in treatment difficulties when flows exceeded 182 Ml/d. Improved polymer dispersion and increased delay between coagulant and coagulant aid dosing resulted in marked improvement in floc blanket stability and settled water quality. This enabled substantial savings in treatment chemical costs to be made and increased the treatment capacity of the works during the period when water temperatures were low. Changes in filter washing practices combined with improved settled water quality reduced the number of daily filter washes, thereby further reducing costs. (Baker-IVI)
W86-01520

MODELING THE EFFECTS OF HYDROLYZED ALUMINUM AND SOLUTION CHEMISTRY ON FLOCCULATION KINETICS,
Syracuse Univ., NY. Dept. of Civil Engineering.
R. D. Letterman, and D. R. Iyer.
Environmental Science and Technology, Vol. 19, No. 8, p 673-681, August, 1985. 7 Fig, 4 Tab, 29 Ref, 1 Append.

Descriptors: *Flocculation, *Computer models, *Aluminum compounds, Model studies, Coagulation, Solution chemistry, Surface properties, Ionization, Complexation, Particulate matter.

Computer programs are available that allow self-consistent calculations to be made simultaneously for solution and surface chemical equilibria. One of these programs, an augmented version of MINEQL, employs the Gouy-Chapman-Stern-Grahame model of the electrical double layer to account for the distribution of charge and potential at the solid solution interface. In this study the modified program has been used to predict the effects of solution and suspension variables on flocculation efficiency when aluminum salt coagulants are used. Electrophoretic mobility measurements and constant pH titrations with the surface complexing sulfate ion have been used to determine intrinsic surface ionization and complexation constants for the aluminum sites. Expressions that relate the model-predicted electrical double-layer characteristics of the aluminum-treated particles and the amount of aluminum hydroxide coating on the particles to the efficiency of flocculation are also employed. For the simple system tested, model predictions of relative flocculation efficiency are in reasonable agreement with batch flocculation results. (Author's abstract)
W86-01617

RATE CONSTANTS OF REACTIONS OF OZONE WITH ORGANIC AND INORGANIC COMPOUNDS IN WATER - III; INORGANIC COMPOUNDS AND RADICALS,
Eidgenoessische Anstalt fuer Wasserversor
Abwasserreinigung und Gewaesserschultz,
bendorf (Switzerland).
For primary bibliographic entry see Field 2K
W86-01641

**ADSORPTION OF HUMIC ACIDS
POWDERED ACTIVATED CARBON; TH
FLUENCE OF SODIUM TRIPHOSPHAT
SORPTION DES ACIDES HUMIQUES
CHARBON ACTIVE EN POUDRE INFLU
DU TRIPHOSPHATE DE SODIUM),**
Limoges Univ. (France). Lab. de Genie Chi
Traitement des Eaux.
P. Lafrance, and M. Mazet.
Water Research, Vol. 19, No. 8, p 1059-1064
6 Fig, 20 Ref.

Descriptors: *Adsorption, *Humic acids, *A
ed carbon, *Sodium triphosphate, Water trea
Detergents, Fulvic acids, Electrokinetics,
gen ion concentration, Phosphates.

The removal of natural humic and fulvi
stances found in water supplies, through the
activated carbon beds is under study. The ef
a main component of domestic detergents,
triphosphate (STP), on the adsorptive capac
powdered activated carbon (PAC) for co
cially supplied humic acids was determined
ferent pH values in distilled water. A first
equilibrium study showed an effective en
ment of adsorption capacity for humic aci
function of STP concentration in a non bu
media (pH of distilled water, close to 5.0).
absorption analysis of humic acids indica
increase of 93% (500 mg/l PAC) and 133%
mg/l PAC) in the carbon adsorption efficien
a STP concentration from 0.2 to 1.0 mM. A
batch equilibrium study led to adsorption
erms for humic acids in distilled water, as
tion of STP concentration and initial pH va
the non-buffered multicomponent system. F
lich isotherms showed an increase in the a
tion capacity of the PAC for humic acids,
decrease in pH and an increase in STP con
tion. The adsorption capacity for humic a
reduced at high pH values in the presence o
in comparison with results obtained with d
water. Electrokinetic measurements of PA
pensions indicates that both humic acids an
induce a negative variation of the zeta poten
carbon particles. In such a binary system, th
potential is a linear function of the pH; the
tive surface charge of the carbon increasin
an elevation of pH. Some adsorption of t
phate polyanion from solution could occur
tributing to the apparent negative surface
of PAC particles. (Moore-IVI)
W86-01649

**REMOVAL OF RADON FROM WATER
PLIES,**
Maine Univ. at Orono. Dept. of Civil Engine
J. D. Lowry, and J. E. Brandow.
Journal of Environmental Engineering, Vo
No. 4, p 511-527, August, 1985. 13 Fig, 2 T
Ref. U.S. EPA grant R808724.

Descriptors: *Radon, *Water treatment,
pollution, Activated carbon, Adsorbants,
chemistry, Water supply, Groundwater.

Granular activated carbon (GAC) adsorpt
extremely effective for the removal of radon
water supplies. A high removal efficien
achieved through an adsorption/decay steady
that can result in near-background radon
with currently available commercial GAC
An adsorption/decay steady state analysis
upon secular equilibrium shows that the life
GAC will be in terms of decades with resp
radon. A variety of GAC products were eva
for radon removal and laboratory and fiel
are presented to document the steady stat
formance for water supplies ranging in conc
tion from 1,500-750,000 pCi/L. Because rado
its daughters build to steady state levels
sponding to the influent mass loading, the
bed becomes a source of low gamma radiatio

relationship is presented to estimate the
activity of the bed as a function of the
radon concentration. This relation and
d measurements show that the low level
f GAC bed does not present a problem
ast majority of high radon wells. (Au-
tract)
9

TIVE COATINGS FOR WATER STOR-
NKS AND WATER TREATMENT FA-
,
emical Co., Edison, NJ.
ary bibliographic entry see Field 8G.
3

YL TRISULPHIDE AND OBJEC-
E ODOURS IN POTABLE WATER,
Australian Inst. of Tech., South Bentley.
Applied Chemistry.
n, R. Alexander, and R. I. Kagi.
ere, Vol. 14, No. 1, p 85-89, 1985. 2 Fig,

s: *Odor, *Potable water, *Dimethyl
Perth, Western Australia, Sulfur com-
ater conveyance.

tly in the past five years, some residents
the metropolitan area north of Perth,
ustralia, experienced unpleasant odors in
supply. These odors were described as
ulfidic or like cooked vegetables. The
les were often ephemeral and extremely
n occurrence. The swampy odor was
t in water samples taken from the water
ns or residences. Dimethyl trisulfide
in samples of potable water in concen-
ging from 5 to 250 ng/l. The presence
l trisulfide in concentrations greater
l was associated with the objectionable
ater samples. The odor intensity and
isulfide concentrations increased in dis-
ains with increasing distance from a
ervoir. The mechanism of formation of
isulfide in the water supply is not yet
ore-IVI)

AND MUTAGENICITY EVALUA-
VATER COAGULATED WITH MOR-
EIFERA SEED PREPARATIONS
H, PROTOZOAN, BACTERIAL, CO-
ENZYME AND AMES SALMONEL-
,
t. for Water Research, Pretoria (South

J. L. Slabbert, W. S. G. Morgan, and
n.
Vol. 11, No. 1, p 9-14, January, 1985.
13 Ref.

*Toxicity, *Mutagenicity, *Coagu-
ga, *Water treatment, Fish, Protozoa,
nzyme inhibition, Fish behavior,
osides.

ifera seed preparations equivalent to
l of cotyledon powder generally used
lation of drinking-water in some rural
xic effects on fish (guppies) (Poecilia
protozoa (Tetrahymena pyriformis),
cherichia coli) and inhibited the
lcholinesterase. The preparations had
coliphages or the enzymes lactic dehy-
invertase, nor did they display muta-
in Ames Salmonella mutagenicity
ntrations as low as the equivalent of
ledon powder affected the oxygen
f T. pyriformis, 30 to 40 mg/l induced
locomotor behavior patterns of gup-
e 96-h LC50 for guppies was 196 mg/
mutagenicity assays yielded negative
tch and serial extracts representing
t of up to 1,000 mg/l cotyledon
city was limited to seed cotyledons;
lls) had no effect. The results suggest
fects were due to the antimicrobial
alpha-L-rhamnosyloxy) benzyl isoth-
glycosidic mustard oil. In view of complex associations of the toxin with organic matter, instability and the mechanism of action, it would, however, not appear to constitute a human health risk, at least not in the concentrations generally involved in the utilization of the seeds for nutritional, medicinal or water purification purposes. (Author's abstract)
W86-01858

EVALUATION OF THE ACTIVATED ALUMINA PROCESS FOR FLUORIDE REMOVAL FROM DRINKING-WATER AND SOME FACTORS INFLUENCING ITS PERFORMANCE,
National Inst. for Water Research, Pretoria (South Africa).
J. J. Schoeman, and G. R. Botha.
Water S. A., Vol. 11, No. 1, p 25-32, January, 1985. 5 Fig, 4 Tab, 23 Ref.

Descriptors: *Water treatment, *Fluoride removal, *Drinking water, *Activated alumina, Caustic soda, Alum, Hydrogen ion concentration, Design criteria, Costs.

The activated alumina defluoridation process was evaluated on an underground mine water containing approximately 8 mg/l of fluoride. The objectives of the study were to compare regeneration methods (caustic soda vs. aluminium sulfate (alum)), determine the importance of feedwater pH adjustment (pH 5 to 6) on process performance, establish design criteria for a 518 cu m/d plant, and to determine the economics of the process. Fluoride could be reduced from approximately 8 to less than 1 mg/l. Approximately one and a half times as much product water of a better quality could be produced with caustic soda than with alum as regenerant. Silicate and hydroxyl ions appeared to compete more strongly with fluoride ions for exchange sites when the pH of the feed was greater than 7. This resulted in a much reduced capacity for fluoride removal. The operating fluoride exchange capacity for design purposes was determined at 3.2 g/l alumina and the total defluoridation costs for a 518 cu m/d plant were calculated at R 0.33/cu m of treated water. (Author's abstract)
W86-01859

TRANSFER OF ACTIVE CHLORINE FROM CHLORAMINE TO NITROGENOUS ORGANIC COMPOUNDS. 2. MECHANISM,
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
R. A. Isaac, and J. C. Morris.
Environmental Science and Technology, Vol. 19, No. 9, p 810-814, 1985. 4 Fig, 4 Tab, 14 Ref.

Descriptors: *Chloramine, *Nitrogen compounds, *Chlorination, Organic compounds, Hydrolysis, Chemical reactions, Chemical kinetics.

In the kinetics of Cl(+) (i.e., active chlorine) transfer from NH2Cl (chloramine) to nitrogenous organic compounds, there are two plausible pathways: hydrolysis, and direct transfer. Transfer of active chlorine from NH2Cl to nitrogenous organic compounds occurs by direct transfer as well as by hydrolysis of NH2Cl which forms HOCl which then can react with the nitrogenous substrates. The nitrogenous compounds investigated fall into two categories: those that form zwitterions and anions and those that form primarily neutral and positive species. In this study, direct transfer was the dominant pathway and involved a second-order reaction - first order in NH2Cl and the nitrogenous substrate. At least two plausible mechanisms can explain the observed data, and a reasonable correlation exists between the absolute rate constants and the basicity of the nitrogenous receptor. Either hydrolysis of NH2Cl or direct transfer of Cl(+) can be the primary pathway depending on the concentrations of the reactants. (Moore-IVI)
W86-01871

HIGH-TECH SOLUTION TO CONTAMINATED DRINKING WATER,
Pirnie (Malcolm), Inc., White Plains, NY.
G. P. Westerhoff, and R. Miller.
Consulting Engineer, Vol. 65, No. 3, p 34-37, September, 1985. 2 Fig.

Descriptors: *Granular activated carbon, *Organic compounds, *Drinking water, *Water treatment, Water treatment facilities, Design criteria, Adsorption, Cincinnati, Ohio.

The nation's first large-scale facility using granular activated carbon is being built to remove a broad spectrum of organic contaminants from the city's drinking water in Cincinnati, Ohio. Cincinnati draws raw water for its California Water Treatment Plant from the Ohio River. The California Water Treatment plant is a typical alum coagulation/rapid sand filter type plant, with flow going from the filters to two large clear wells prior to distribution. A pilot study, conducted in 1977, had as its primary objective the determination of whether GAC was a feasible method for removing trace organics from water while treating it for use as drinking water. While the use of GAC is not new in the US, it has been largely limited to taste and odor control in potable water system filter beds, polishing in wastewater reclamation operations, and in certain industrial processes. Integrating the design of the 175 mgd facility into an existing treatment plant was a challenging task. Special design features and construction features are described. (Baker-IVI)
W86-01880

PRACTICAL, LOW-TECH PLANT ASSURES SUPPLY TO 2010,
Fairfax County Water Authority, Merrifield, VA.
F. P. Griffith, and A. H. Adams.
Consulting Engineer, Vol. 65, No. 3, p 40-43, September, 1985. 1 Table.

Descriptors: *Water treatment, *Water treatment facilities, *Drinking water, Design criteria, Filtration, Disinfection, Potomac River, Fairfax, Virginia.

The James J. Corbalis Water Treatment Plant, in operation in Fairfax, Virginia, is the first step in a program of capital imporvements that will provide adequate and economical water service for the area into the 21st century. This is the first facility in Virginia to use the Potomac River as a source of water supply. These facilities are a principal element of a water supply program now being developed by area water utilities to avert future shortages during periods of drought through coordinated management of available water resources. The plant is a conventional high rate treatment facility that includes the following processes: rapid mixing, flocculations, sedimentation, filtration, fluoridation, and disinfection; finished water storage and pumping; backwash water reclamation; and solids dewatering by plate and frame filter presses. (Baker-IVI)
W86-01882

HETEROTROPHIC BACTERIA IN WATER DISTRIBUTION SYSTEMS. I. SPATIAL AND TEMPORAL VARIATION,
Centre des Sciences de l'Environment, Metz (France).
A. Maul, A. H. El-Shaarawi, and J. C. Block.
Science of the Total Environment, Vol. 44, p 201-214, 1985. 6 Fig, 3 Tab, 17 Ref.

Descriptors: *Heterotrophic bacteria, *Water conveyance, *Spatial distribution, *Temporal distribution, Drinking water, Bacteria, Water distribution, Metz, France, Chlorine, Water mains, Retention time, Water temperature.

The drinking water distribution system of the city of Metz in France was sampled intensively during six monthly surveys which were designed to determine the spatial and temporal distribution of total heterotrophic bacteria in the network. A non-hierarchical nearest-centroid clustering method was used for dividing the water distribution system into zones corresponding to different levels of bacterial density. The general pattern of the spatial heterogeneity showed a high degree of reproducibility. Since the frequency distribution of total heterotrophic bacteria within the zones was compatible with

the negative binomial distribution, the water distribution system studied may be considered as being composed of several heterogeneous subsystems. The consistency of this structured spatial dispersion pattern of bacteria in light of some physical and chemical characteristics of the system is evident. In consideration of the principal features of flow in the system relevant to the layout of water mains, the location of zones of highest bacterial concentrations have been attributed to lower levels of chlorine residuals and prolonged retention time of the water in the network, especially in the storage units, before reaching the various distribution areas. Although the monthly variation in the bacterial concentration of the entire system showed a marked increase which was concomitant with warmest water temperatures, the zones were subject to noticeable discrepancies in the range of temporal variation. (Author's abstract)
W86-01914

HETEROTROPHIC BACTERIA IN WATER DISTRIBUTION SYSTEMS. II. SAMPLING DESIGN FOR MONITORING,
Centre des Sciences de l'Environment, Metz (France).
A. Maul, A. H. El-Shaarawi, and J. C. Block.
Science of the Total Environment, Vol. 44, p 215-224, 1985. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Water quality control, *Monitoring, *Bacteria, *Water conveyance, Drinking water, Water quality, Variability, Sampling.

Information on the spatial and temporal variability of bacteriological data from a water distribution system is used to develop a sampling design for use in future water quality monitoring. The water distribution system is considered to be composed of several zones where the variation of bacterial counts in each zone is modelled by the negative binomial distribution. Under the assumption that the objective of monitoring is to determine whether or not the mean bacterial density of the water exceeds a specific standard, a criterion is given which determines the optimal number of sampling stations allocated to each zone. These stations are determined by assuming that either the risk of sampling is prespecified or that the total number of stations to be sampled is predetermined. Sequential sampling offers another way of monitoring the level of bacterial density in a system. The procedure takes into account the concentration of bacteria in the samples after each collection. (Baker-IVI)
W86-01915

5G. Water Quality Control

APPROACH TO THE RESTORATION OF AQUATIC VEGETATION IN THE XIHU LAKE OF HANGZHOU, WITH REFERENCE TO THE WATER QUALITY PROBLEM (IN CHINESE),
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
C. Hongda.
Acta Hydrobiologica Sinica, Vol. 8, No. 2, p 237-244, May, 1984. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Lakes, *Xihu Lake, *Hangzhou, *China, *Water quality, *Aquatic vegetation, Phytoplankton, Fish, Lake management, Nutrients, Nitrogen, Phosphorus, Light penetration, Oysters, Mollusks.

The reasons for the deterioration of aquatic vegetation in Xihu Lake were analyzed and the possibility of, and approach to, restoration of the vegetation was investigated with reference to the water quality problem. There were three main causes for the deterioration: the overstocking of plant-eating fish such as Ctenopharyngoden idellus and Megalobrama amblycephala, the rapid growth of phytoplankton, and the deepening of the lake due to artificial removal of sand. Excessive numbers of plant-eating fish destroyed the vegetation by grazing on it. Due to pollution, the water contained large amounts of nitrogen and phosporous. These nutrients, in turn, were taken in by the phytoplankton, causing a rapid increase of these plants. The excessive phytoplankton deprived the underwater plants of their sun energy by blocking the amount of light penetrating the water. Finally, the deepening of the lake could cause a problem by lowering the light intensity at each and different depths. The situation could be remedied by lowering the water level of the lake, thus permitting more light thru; by limiting the number of plant-eating fish; and by planting new vegetation, using both natural and artificial means. After the vegetation was restored, it might prove to be effective in the removal of nitrogen and phosphorous, thus depriving the phytoplankton of their nutrient sources and curbing their growth. A decrease of these plants would allow higher light intensity to reach all levels of water. Study of using aquatic vegetation in purifying water in lakes had never carried out in this country. But yet, as a way of gaining experience, it was highly recommended that such a project should be started hand in hand with the restoration of the vegetation in Xihu Lake. In order to reduce the amount of nitrogen, phosphorous, and phytoplanktons, the stocking of plant-eating fish should be strictly controlled. If it were possible, the types of fish should be chosen in such a way that they mainly graze on the phytoplankton and organic debris. Furthermore, oysters and mollusks should be protected because they also helped to reduce the amount of organic debris and phytoplankton. (Eng-IVI)
W86-01324

ESTIMATING THE EXTENT OF REDUCTION NEEDED TO STATISTICALLY DEMONSTRATE REDUCED NON-POINT PHOSPHORUS LOADING TO LAKE ERIE,
Heidelberg Coll., Tiffin, OH. Water Quality Lab.
R. P. Richards.
Journal of Great Lakes Research, Vol. 11, NO. 2, p 110-116, 1985. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Great Lakes, *Lake Erie, *Eutrophication, *Phosphorus, Nonpoint pollution sources, Land management, Monitoring, Water pollution control, Statistical methods, Pollution load.

A method is presented for estimating the amount of change needed to establish a statistically significant reduction, based on the standard t-test, to nonpoint phosphorus loading in Lake Erie. Analysis of data from the Sandusky River, a north-central Ohio tributary of Lake Erie, indicates that the necessary change is about 35% of the current loads. Assuming that implementation rates will decrease with time, the time spans needed to achieve these changes will differ even more dramatically. Based on projections of implementation rates, a 20% change would require 8 years, but a 35% change would take at least 25 years. Even in cases where best management practices might produce sufficient load reductions for the change to be documented statistically without adjusting the load data for discharge, doing so will allow the change to be documented earlier in the implementation period, and to be more certainly attributed to the best management practices, rather than some other cause. Success in demonstrating a reduction in loads is assisted by a monitoring program which provides sufficient data to calculate loads accurately. Where such programs have been in place long enough to provide a historical database, high priority should be placed on continuing the intensive monitoring effort without change. Otherwise, the changes in sampling strategy will introduce unknown errors and biases into the comparison. This could prevent a real change in loads from being detected statistically, or produce a serious but statistically significant difference where no change in loads had occurred. (Baker-IVI)
W86-01343

LAKE ERIE NUTRIENT LOADS, 1970-1980,
Corps of Engineers, Buffalo, NY. Lake Erie Wastewater Management Study.
S. M. Yaksich, D. A. Melfi, D. B. Baker, and J. W. Kramer.
Journal of Great Lakes Research, Vol. 11, No. 2, p 117-131, 1985. 10 Fig, 3 Tab, 18 Ref.

Descriptors: *Lake Erie, *Nutrients, *Pollution load, Phosphorus, Eutrophication, Great Lakes, Mathematical models, Chlorides, Silica, N
Water pollution control.

A nutrient sampling program was establi
the Lake Erie Wastewater Management S
the fall of 1974. This sampling program do
ed established tributary loading to the lake
data were used to define nutrient loads
Erie. Total phosphorus during this period
creased as a result of phosphorus rem
wastewater treatment plants. The effect
reductions can be seen in the lake concen
and were predicted by a three basin pho
budget model developed in the early 1970
ble orthophosphate loads, chloride loads, a
loads have decreased over the period. N
species were highly variable and increas
the period. (Baker-IVI)
W86-01344

**CHANCE-CONSTRAINED/STOCHASTI
LINEAR PROGRAMMING MODEL FO
RAIN ABATEMENT - I. COMPLETE
EARITY AND NONCOLINEARITY,**
Waterloo Univ. (Ontario). Dept. of Civil E
ing.
For primary bibliographic entry see Field 5
W86-01381

**COMPARISON OF TWO MODELS FO
DICTING RIVER WATER QUALITY,**
Birmingham Univ. (England). Dept. of Civ
neering.
For primary bibliographic entry see Field 5
W86-01438

**MOBILE OXYGENATION IN THE T
ESTUARY,**
Thames Water Authority, London (Englan
I. M. Griffiths, and P. J. Lloyd.
Effluent and Water Treatment Journal,
No. 5, p 165-169, May, 1985. 5 Fig, 1 Tab

Descriptors: *Water quality control, *
ation, *Thames River, *England, Thames
Dissolved oxygen, Urban runoff,
wastewater.

Discharges of storm sewage from the co
sewers in inner London during times o
rainfall present the greatest current threat
quality of the tidal Thames. A prototype
ation barge was acquired in response to th
which is capable of injecting ten ton
oxygen per day into the estuary. The
Bubbler has been operational for over thr
during which time an extensive evaluatio
unit was undertaken. Minor mechanical p
which occurred in the post commissionin
have been largely overcome and the p
proved reliable. It has been possible to
deploy the Thames Bubbler in response to
rating river conditions and it can easily be
station at the point of minimum dissolved
On at least one occasion the Thames bub
prevented a major fish mortality. There is
case for acquiring additional units to incre
capacity In providing a means of rapidly
ing to changing situations, the Thames
adds a new dimension to water quality
Some of the potential applications for use
in advance of current traditional control
(Baker-IV)
W86-01439

**WATER FLOW AND SWELLING PRE
IN NON-SATURATED BENTONITE-
CLAY BARRIERS,**
Luleaa Univ. (Sweden).
For primary bibliographic entry see Field 2
W86-01455

**APPLICATION OF ARTIFICIAL CLA
THE CONTROL OF TOXIC POLLUTAN**
Chemfix International Ltd., London (Engla
For primary bibliographic entry see Field 5
W86-01456

AL AND CHEMICAL BEHAVIOUR OF ASED BARRIERS UNDER PERCOLA- ITH TEST LIQUIDS,
ne Univ. Braunschweig (Germany, F.R.). Grundbau und Bodenmechanik.
s, and E. Reuter.
ng Geology, Vol. 21, No. 3/4, p 301-310, 5. 7 Fig, 1 Tab.

rs: *Clay, *Liners, *Barriers, *Percola- ste disposal, Physical properties, Chemi- ties, Water pollution prevention, Benton- nt, Leaching, Adsorption, Ion exchange, tic force.

ter can be effectively protected from natural clay deposits where the waste is by horizontal barriers or vertical liners ntonite or cement mixtures. The perme- lay liners for waste deposits was investi- g different aggressive test liquids (dis- r, two organic and five inorganic test ne used test-liquids were analyzed before ercolation of the liner materials. Leach- orption effects can thus be recognized. olation the liner specimens were minera- vestigated in order to obtain additional n ion exchange processes by comparison analyses, and on the long-term durabili- ner materials. Differences in permeabil- attributed to ion exchange processes or adsorption porcesses) and alteration ostatic forces in the clay. (Moore-IVI)

NG THE WATERBALANCE OF A YER COVER OF A DOMESTIC NDFILL,
Univ. (Germany, F.R.). Lehrstuhl fuer e Geologie.
Neff, H. Walter, and S. Wohnlich.
Geology, Vol. 21, No. 3/4, p 341-347, 5 Fig, 5 Ref.

*Water pollution control, *Landfills, rriers, Water movement, Lysimeters, ermeability, Groundwater protection.

system is described that is to be in- domestic waste landfill to reduce the f leachate. The landfill will be covered stem and simultaneously get an under- ier for groundwater protection. The ogram uses flexible large-scale lysi- il moisture measurements for estimat- r balance within the covering system. al strata at the site consist of 40 m of and and gravel underlaid by a mini- ay layer. The water table is found at a 18 m and groundwater is used for er supply at three areas around the ne outer edge of the site the slopes nt of 1:3 up to a height of 30 m. The disposal is formed by a plateau. The lesigned as a fold-roof type - several 00 m latitude and varying length. In each segment a water canal is situat- s of 2.5% rise on each flank towards e canals drain to the outside with a %. The covering system consists of sand filter layer, barrier layer, and pport layer. Centered in the testing large scale lysimeters each of a di- 5 to 16 m. Lysimeter I is designed to watercycle of the covering system ed system. Lysimeter II is an open n the covering system, gathering in- the vertical leachate below the bar- hout taking horizontal water move- count. Measurement of soil moisture n the covering system is another quantify the water movement. By n proble at several measuring points area, soil water contents at different orded weekly. (Baker-IVI)

CEMENT-BENTONITE CUT-OFF CONTAIN POSSIBLE POLLUT- I A LANDFILL CONTAINING LUTED DREDGING SPOILS,
Laboratorium voor Grondmechanica, Delft (Netherlands).
M. Loxham, and F. A. Westrate.
Engineering Geology, Vol. 21, No. 3/4, p 359-365, June, 1985. 5 Fig, 1 Tab, 4 Ref.

Descriptors: *Landfills, *Water pollution control, *Spoil banks, *Cutoff walls, Groundwater pollution, Water pollution sources, Heavy metals, Groundwater barriers, Bentonite, Cement.

The approach channels and canals of major ports must be regularly dredged to keep them at depth. The dredged spoil contains pollutants such as heavy metals, PCBs, and pesticides. When this dredging spoil is disposed of either by landspreading or by landfill, potential pollution problems come into play. The dredging spoil from the sea canal at Ghent in Belgium has been landfilled at a specially engineered site at Zelzate. The landfill was designed to an ultimate capacity of some 2.2 million cu m and occupies a total area of about 30 ha. The depot was excavated in fine sand down to a thick clay layer with a low permeability at approximately 25 m below the surface. With this particular dredging spoil, at the ultimate capacity of the landfill, there will be 5600 tons of toxic heavy metals in the fill. To prevent the spread of pollutants from the site to the surroundings a cement-bentonite screen has been constructed down to a thick clay layer 25 m under the surface. Calculations show that this barrier is adequate for the environmental objectives stipulated. The Zelzate site is one of the first and largest examples of the use of cement-bentonite cut-off walls in the field of pollution control. (Baker-IVI)
W86-01460

ACID RAIN: DOUSING COMMUNITY RESOURCES,
K. Anderberg.
American City and County, Vol. 100, No. 2, p 38, 42-44, 49, February, 1985. 2 Fig.

Descriptors: *Acid rain, *Powerplants, *Emissions, *Water pollution control, Sulfur dioxide, Planning, Management, Decision making, Political aspects, Water conveyance, Water treatment.

While almost everyone acknowledges that there is a problem with acid rain, the area of disagreement is centered around whether action is needed now or whether time can be allowed to pass while more data are gathered on the situation. Uncertainty remains the key word in discussions of acid rain. A recommendation regarding the reduction of sulfur dioxide emissions from coal fired electric power generating stations would have only a minimal effect on electric rates; it would still be highly politicized. For public officials, the problem transcends politics. They must be concerned with public welfare. Europe recognized and began dealing with the problem nearly two decades ago. In the US, forests in New England, Appalachia and California's Sierra Nevada Mountains are exhibiting signs of dead, dying and damaged trees believed to have been caused by acid precipitation. The areas usually affected are far removed from the actual source. Northeastern states have perhaps the greatest concern about acid precipitation's effect on water quality, since water distribution systems in this region often have been in place for decades. The challenge to water system operators focuses on the corrosive water's effect on the distribution system. Highly corrosive or acidic water effects a distribution system in three ways. First there is a health danger associated with higher than recommended levels of heavy metals. Second is the deterioration of pipes and joints that occurs, resulting in leaks, restricted flows and shortened lifespan of the system. The most effective method of protecting consumers from corrosive water and associated contaminants is through corrosion control at the treatment plant. Any emissions control program is likely to be deferred this year. The present administration also appears to prefer to wait for research to be completed before taking any action. (Baker-IVI)
W86-01488

LIMITATIONS OF PHOSPHORUS WATER QUALITY CRITERIA,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
A. N. Sharpley, S. J. Smith, and R. G. Menzel.
Journal of Soil and Water Conservation, Vol. 40, No. 3, p 283-284, May-June, 1985. 6 Ref.

Descriptors: *Eutrophication, *Phosphorus, *Water quality standards, Runoff, Agricultural chemicals, Water quality control, Streams, Lakes, Rain.

The transport of phosphorus from agricultural land in runoff can result in a deterioration of water quality from accelerated eutrophication. Such problems led to the establishment of critical levels for soluble P at 10 micro-g/l and total P at 20 micro-g/l. Results of a water quality monitoring study in Oklahoma and Texas indicate that P concentrations in surface runoff and groundwater from relatively pristine agricultural land were found to be sufficient to stimulate accelerated eutrophication according to the critical-P-concentration guidelines. In addition, P concentrations in rainfall often exceed the critical levels. If runoff and rainfall do not flow directly into an impoundment, soluble P and total P concentration may increase or decrease as a result of release or uptake and erosion or deposition during transport. It may be unrealistic in most cases to attain or maintain P concentration in surface waters below the critical levels. Consequently, the use of these levels as the sole criteria in quantifying permissible tolerance levels of P in surface water as a result of differing management practices should be discouraged. (Baker-IVI)
W86-01492

WATER QUALITY EFFECTS OF PINE FLATWOODS SILVICULTURE,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
For primary bibliographic entry see Field 4C.
W86-01494

STUDIES ON THE POLLUTION CONTROL OF THE YA-ER LAKE (IN CHINESE),
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
Y. Zhang, Z. Chen, Y. Tan, M. Sun, and D. Zhuang.
Acta Hydrobiologica Sinica, Vol. 8, No. 1, p 113-124, November, 1983. 3 Fig, 4 Tab, 44 Ref.

Descriptors: *Water pollution control, *Ya-Er Lake, *China (Peoples Republic), Pesticides, Oxidation ponds, Biodegradation, Biological wastewater treatment, Aquaculture, Eutrophication, Water reuse, Parathion, Malathion, Dimethoate, BHC.

Ya-Er Lake is located in the west part of E-Cheng county, Hubei Province (Peoples Republic of China. In the past it covered about 6000 ha (now 2000 ha) and was one of the main fish production district in the province. Since 1962 the lake was polluted by wastewater of a chemical plant which manufactured parathion, malathion, dimethoate and BHC. The aquatic ecosystem was ruined. About forty percent of fish population were of abnormal form. After the ecological surveys carried out in 1972-1974, the pollution control of Ya-Er Lake was studied. The research works included: survey of the self-purification of pesticides of the lake, simulation experiment on the processes that would occur in the oxidation ponds, and the biological degradation of pesticides in aquatic environment, etc. The pollution control system of Ya-Er Lake consists of the following parts: 1. Oxidation ponds system. At one end of the lake, four oxidation ponds, connected in series, were constructed. The total area is about 187 ha and 3 m in depth. The retention time of wastewater is about 80 days when the amount of the effluent is 70,000 tons per day. The effluent from the pond system is then discharged into another pond for culturing fingerling fish. Therefore the nutritive elements contained in the effluent can be utilized by the fish and the eutrophication process is retarded in the receiving water body. 2. Sewer pipelines, 5.9 km long, between the chemical plant and oxidation

ponds. 3. Two outfall canals (12.8 km long) which run along either side of the oxidation ponds collect and drain the rainwater into the lake. They are also used as water sources for farming. The above facilities were nearly completed in 1976. The operating experience for four years showed that the system was quite successful in district pollution control. The oxidation pond system can effectively reduce the organic wastes. The average removal efficiences for COD, organic phosphate, p-nitrophenol, parathion, malathion, dimethaote and BHC are 77.3, 82.5, 99.3, 98.7, 98.4, 92.9 and 86.2 percent, respectively. The daily waste-water load was 80,000 tons. Biological survey showed that the biotic community in the Ya-Er Lake ecosystem has been recovering since 1977. The rate of abnormal type of fish decreased to 0.1% in 1979. The BHC residues in fish decreased from 15-30 mg/kg to 0.55 mg/kg (in skeletal muscle). The BHC residues of farm products in 1979 were 2.7-9.4 fold less than those before the construction of the oxidation ponds system. (Author's abstract)
W86-01513

COLLIFORD LAKE IN CORNWALL: FROM PROMOTION TO UTILIZATION,
For primary bibliographic entry see Field 6B.
W86-01519

HYDRAULIC CONDUCTIVITY OF TWO PROTOTYPE CLAY LINERS,
Geo-Con, Inc., Pittsburgh, PA.
S. R. Day, and D. E. Daniel.
Journal of Geotechnical Engineering, Vol. 111, No. 8, p 957-970, August, 1985. 13 Fig, 5 Tab, 2 Ref.

Descriptors: *Permeability coefficient, *Clay liners, *Liners, Landfills, Infiltration, Lagoons, Clays.

Two prototype liners were constructed at a site near Austin, Texas, using clays of low and high plasticity. The clays were compacted to 100% of standard Proctor density at a water content slightly wet of optimum using a sheepsfoot roller. The overall hydraulic conductivity (k) of each liner was determined by ponding water on the liners and measuring the rate of seepage. The field-measured k's of the liners were suprisingly high (0.000004 and 0.000009 cm/s). After water in the ponds was removed, laboratory permeability tests were performed on hand-carved samples obtained from the liners, on samples obtained with a thin-walled sampling tube, and on laboratory-compacted samples. Field permeability tests were also performed with ring infiltrometers. The tests showed that: (1) Essentially all of the laboratory tests, even on undisturbed samples, produced a measured k that was approximately 1,000 times less than the field-measured k; and (2) ring infiltration tests showed considerable scatter but the average k was close to the overall field-measured k. The findings raise important questions about whether laboratory permeability tests on compacted clay are relevant to clay liners and reinforce previous suggestions that compacted clay liners may contain numerous hydraulic defects such as fissures, slickensides, zones of poor bonding between clods of clay, and zones of relatively poor compaction. The desirability of field permeability tests is evident from the results reported. (Author's abstract)
W86-01531

CASE STUDY ANALYSIS FOR SEASONAL NITRIFICATION: ECONOMIC EFFICIENCY AND WATER QUALITY PRESERVATION,
Lafayette Coll., Easton, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-01543

MANAGEMENT OF CONTAMINATED DREDGED MATERIAL FROM THE HUDSON RIVER,
Pirnie (Malcolm), Inc., White Plains, NY.
J. S. Reed, J. C. Henningson, and L. Houston.
Northeastern Environmental Science, Vol. 3, No. 3/4, p 216-220. 2 Fig, 6 Ref.

Descriptors: *Environmental effects, *Dredging, *Hudson River, *New York Harbor, *Champlain Canal, Spoil disposal, Estuarine environment, Land disposal, Polychlorinated biphenyls, Waste disposal.

The Hudson River is an active commercial and recreational waterway requiring regular maintenance dredging. Disposal of the dredged material and methods of dredging and volume of material removed must be managed in a manner consistent with the level of sediment contamination. Four studies have been undertaken - two in the upper Hudson, and one each in the estuary and in New York Harbor - which evaluate dredge disposal practices appropriate to each region. The use of dredged material from the New York Harbor is being studied to meet the demand for sanitary landfill cover which is in increasingly short supply in the New York area. The study is being conducted for the New York District Corps of Engineers, as an option to ocean disposal. In the estuary, a 10-year maintenance dredging EIS and management plan were developed for the New York District Corps of Engineers. A total of 92 potential upland disposal sites were identified, a portion of which would be suitable for disposal of hazardous waste. In the upper Hudson consideration was also given to the maintenance dredging program conducted by the NYS Department of Transportation on the Champlain Canal. This evaluation will serve as the basis for an environmental impact on the 10 year maintenance program for the canal. In the Upper Hudson a remedial dredging program was developed for the New York State DEC to remove 'hot spots' containing the highest concentrations of PCB. (Author's abstract)
W86-01564

SIMPLE METHOD TO ESTIMATE LAKE PHOSPHORUS CONCENTRATIONS RESULTING FROM NATURAL, BACKGROUND, LOADINGS,
Pavia Univ. (Italy). Ist. di Entomologia Agraria.
For primary bibliographic entry see Field 2H.
W86-01640

ANALYSIS OF VARIANCES AS DETERMINED FROM REPLICATES VS. SUCCESSIVE SAMPLING,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
E. A. McBean, and F. A. Rovers.
Ground Water Monitoring Review, Vol. 5, No. 3, p 61-64, Summer, 1985. 3 Fig, 9 Tab, 1 Ref.

Descriptors: *Monitoring, *Analysis of variance, *Sampling, Mathematical studies, Groundwater pollution.

Monitoring requirements as specified within the Resources Conservation and Recovery Act rely on increases over background level of the the concentrations of parameters to define when a unit is not in compliance. Evidence of groundwater contamination at a compliance point may be based on statistical comparisons of data from replicate analyses carried out on a single sample. A field test of the variances arising from between samples and within sample replicates indicated that the background concentration is fundamentally important in the statistical significance testing for the compliance point monitoring. Since the variance of the background concentration is best measured by sampling error, as well as analytical error, there is a strong argument that a program of background quality determination should involve successive sampling rather than the splitting of samples into aliquots. (Baker-IVI)
W86-01698

GROUTING AS A REMEDIAL TECHNIQUE FOR BURIED LOW-LEVEL RADIOACTIVE WASTES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. P. Spalding, L. K. Hyder, and I. L. Munro.
Journal of Environmental Quality, Vol. 14, No. 3, p 389-396, 1985. 7 Fig, 3 Tab, 17 Ref.

Descriptors: *Grouting, *Radioactive *Waste disposal, Environmental protectio stabilization, Soil properties, Sodium silica lyacrilamide, Permeability coefficient.

Seven grout formulations were tested in th ratory for their ability to penetrate and to the hydraulic conductivities of soils used a fills for shallow land burial trenches. Soil fr sites, in Oak Ridge, TN, and Maxey Fla were used and both are classified as Typ trochrepts. Three soluble grout form (sodium silicate, polypropenamide (poly mide), and 1,3-benzenediol (resorcinol)-fo hyde) were able to both penetrate soil a columns and reduce hydraulic conductiviti initial values of ca. 10 to the -4th power m 10 to the -8th power m/s. Three particulate (lime (calcium oxide)-fly ash, fly ash-ceme tonite, and bentonite alone) could not p columns; such as formulations would, there difficult to inject into closed burial trenche demonstrations with both sodium silicate lyacrylamide showed that grout could be d ed throughout a burial trench and that backfill hydraulic conductivity could be several orders of magnitude. Field groutin polyacrylamide reduced the mean hydrau ductivity of nine intratrench monitoring we 0.0001 to 10 to the -8th power m/s. Grou low-level radioactive solid waste in situ, th should be an effective technique to correc tions where leaching of buried wastes has result in groundwater contamination. (Auth stract)
W86-01712

USING CREAMS AND ECONOMIC M ING TO EVALUATE CONSERVATION TICES: AN APPLICATION,
Economic Research Service, Washingto Natural Resource Economics Div.
For primary bibliographic entry see Field 5
W86-01715

GROUNDWATER PROTECTION IN FRANCISCO BAY AREA,
California Regional Water Quality Control Oakland.
D. M. Eisenberg, A. W. Olivieri, M. R. Ku P. Johnson, and L. Pettegrew.
Journal of Environmental Engineering, V No. 4, p 431-440, August, 1985. 1 Fig,

Descriptors: *Groundwater pollution, *Sa cisco Bay, *California, *Environmental pro Underground storage tanks, Source of po Water pollution, Legal aspects, Remedial Cleanup.

In the San Francisco Bay Region, the R Water Quality Control Board is now re approximately 140 sites where toxic ch have contaminated groundwater. Many were located through the Board's Unde Tank Leak Detection Program, which subsurface investigations at the sites with ground solvent tanks. New ordinances a laws are expected to result in the disco hundreds more contamination sites in the years. The Regional Board is developing a methodology to assign priorities among cas set of guidelines for establishment of clea jectives on a site-by-site basis. Appropriate tory mechanisms have been selected to enf necessary investigation and clean-up a (Author's abstract)
W86-01724

DESIGN CONSIDERATIONS FOR A LANDFILL LINER,
Rutgers - The State Univ., Piscataway, N of Civil and Environmental Engineering.
A. C. Demetracopoulos, and L. Sehayek.
Journal of Environmental Engineering, V No. 4, p 528-539, August, 1985. 5 Fig, 1 Ref.

ors: *Landfill liners, *Design criteria, anes, Environmental protection, Lea- inings, Diffusion coefficient.

landfill leachate liner design consisting of f v-shaped contiguous elements construct- an impervious membrane, a boxed soil urated with clean water, and a gravel roposed. Certain idealized boundary con- re stipulated and an analytical solution is the diffusional mass transport of leachate the saturated layer. This is used to assess umum value and time-of-occurrence of concentration at the impervious mem- is shown that these two important quanti- nsitive to the diffusion coefficient and the of the saturated layer. A method is for- or the estimation of the diffusion coeffi- ounting for the type of contaminant, the he porous medium, and the possibility of nt adsorption on the soil matrix. The ocedure would be valuable in estimating tial of destruction of the impervious from the chemicals contained in the Author's abstract)
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OUS WASTE CLEANUP: THE PRE- IES,
ental Protection Agency, New York.

neering, Vol. 55, No. 8, p 40-43, August,

s: *Water pollution control, *Cleanup *Landfills, *Waste disposal, *Niagara ardous substances, Groundwater pollu- oring.

suit filed in 1979 named four Hooker that were polluting the Niagara River. involved agreed to negotiate remedial or each of the four sites in turn. S-Area, he list, may serve as a model for other settlements. It provides for a flexible to consideration of alternate technol- may be developed in the future. It phased approach to both defining and existing problems, then suggesting rem- uires monitoring for at least 35 years or nger remains. S-Area is an eight acre t in 1947 on partially reclaimed land river. Wastes were dumped into open ft deep even though groundwater was ft. The remedial plan set forth in the ttlement agreement begins with a sur- dies program similar to those outlined nd sites. Flexibility, extensive use of odels, and extensive monitoring pro- ydraulics, tracer and other chemicals the remedial plan's effectiveness. An chnical remedy proposed for S-Area is hydraulic gradient concept, innovative tried. (Baker-IVI)

FFECTS OF INDIRECT POTABLE USE,
County Sanitation Districts, Whittier,

, R. B. Baird, and J. R. Smyth.
merican Water Works Association, p 985. 1 Fig, 6 Tab, 48 Ref.

*Water reuse, *Potable water, *Public ndwater recharge, Toxicity, Percola- eology, Epidemiology, Chemical con-

xpansion of water reuse through replenishment have been constrained regarding the potential impacts on irect potable reuse, particularly the osure to trace organics, the presence ay be exacerbated by groundwater activities. A five-year, multidisciplin- project was undertaken to evaluate health of using treated wastewater ter replenishment. The study focused er Narrows Groundwater Replenish-

ment Project in Los Angeles County, California, where replenishment with a mixture of imported river water, stormwater, and reclaimed wastewater has been practiced since 1962. The study included: characterization of the quality of the water; toxicological and chemical studies of the water; percolation studies to evaluate the efficacy of soil for attenuating inorganic and organic chemicals in reclaimed water; hydrogeology; epidemiological studies of populations ingesting reclaimed water. The proportion of reclaimed water currently used for replenishment had no measurable impact on either groundwater quality or human health. Recommendations for optimization of groundwater replenishment with reclaimed water are included. (Moore-IVI)
W86-01747

OPTIMIZATION MODELING OF WATER QUALITY IN AN UNCERTAIN ENVIRONMENT,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
D. H. Burn, and E. A. McBean.
Water Resources Research, Vol. 21, No. 7, p 934-940, July, 1985. 2 Fig, 2 Tab, 33 Ref, 1 Append.

Descriptors: *Optimization, *Water quality, *Model studies, Probability, Stochastic process, Dissolved oxygen, Wastewater treatment, Simulation, Costs.

A comprehensive approach to water quality modeling could incorporate the stochastic nature of water quality as a means of assuring compliance with probabilistic water quality standards. An optimization model with an ability to reflect uncertainties present in water quality problems is described. The technique employed is chance constrained programming wherein probabilistic constraints in a water quality optimization problem are replaced with their deterministic equivalents. To illustrate aspects of the proposed methodology, a case study is described which involves the determination of the optimal treatment level at two sources in order to satisfy two objectives of maximizing water quality (at a series of four locations) and minimizing treatment costs at the two sources. Water quality is assumed to be represented by the dissolved oxygen concentration in the river. The uncertainty inherent in the random elements of the problem is characterized using first-order uncertainty analysis for the case study. A lognormal distribution provided a satisfactory fit to the distribution of dissolved oxygen deficit. In choosing an appropriate distribution for this problem, consideration should be given to the loading condition and the probability level which is of interest. (Moore-IVI)
W86-01764

USE OF MACROPHYTES FOR TREATING AGRICULTURAL RUNOFF,
For primary bibliographic entry see Field 5D.
W86-01826

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COMPUTER AIDED MAPPING PROJECT AIDS SEVERN TRENT,
N. McLeod.
Water Services, Vol. 89, No. 1072, p 161-163, June, 1985.

Descriptors: *Severn Trent Water System, *Mapping, *Computers, Automation, Planning, Water supply, Water distribution, Wastewater facilities, England.

The Lower Severn Division, on of the eight divisions of the Severn-Trent Water Authority (England) supplies water to and treats sewage from 780,000 people. The Division is also responsible for maintaining some 658 km of rivers and estuaries. Lower Severn began investigating computer based mapping in May of 1982. A four person multidisciplinary team was set up, which included two independant consultants. Benchmark tests were established to demonstrate to the prospective user the strengths and weaknesses of the systems competing against each other. From the results of the benchmark tests a three workstation system was selected on an initial one-year rental contract. The mapping software is accurate to 1 mm on the ground and stores data on one of 32 reference files, each of which can have 63 levels. Lower Severn found it difficult to produce a financially sound case to purchase computer equipment for mapping purposes only. Thus it was necessary to exploit the full potential of the system's database capability to produce reports of all kinds. The real payoff will come when all the public utilities and the highway authorities all begin to communicate in specifying a system that will be of benefit to them all, and ultimately of benefit to the paying customers, the consumer. (Baker-IVI)
W86-01631

CALCULATING WITH MICROCOMPUTERS,
J. Houston.
Water Services, Vol. 89, No. 1072, p 164-166, June, 1985. 3 Fig, 6 Ref.

Descriptors: *Computers, *Water supply development, Hydrogeological analysis, Spatial analysis, Statistical analysis, Automation.

Microcomputer hardware is now well advanced, capable of carrying out most of the tasks required by professional water engineers. By comparison software has not kept pace and only now are program packages becoming available which use facilities to the full. A wide range of programs are available for the simpler tasks but there are still very few available for more complex data handling. The ease of access to microcomputers and their flexibility means that the software for these machines should not be the preserve of computer scientists. Programs should be and are being developed with the emphasis on ease of use but they are not a substitute for technical knowledge. Microcomputers must support the professional engineer, not replace him. (Baker-IVI)
W86-01632

MEASURING VALUES FOR ENVIRONMENTAL RESOURCES UNDER UNCERTAINTY,
New South Wales Univ., Kensington (Australia). School of Economics.
D. R. Gallagher, and V. K. Smith.
Journal of Environmental Economics and Management, Vol. 12, No. 1, p 132-143, June, 1985. 1 Fig, 17 Ref.

Descriptors: *Planning, *Policy making, *Uncertainty, Water pollution control, Environmental protection, Values, Decision making, Risk.

The relationship between conventional measures of the benefits from changes in environmental amenities under certainty and an individual's valuation of such changes under uncertain conditions is considered. The basic framework used in developing the conditions when the Hicksian compensating and equivalent measures of consumer surplus will bound an individual's value for a change in the likelihood of experiencing an improvement in an environmental amenity is introduced. The analysis is conducted within a contingent commodity framework with state-dependent preferences. This approach allows an individual's valuation of a change in access to an environmental amenity to be considered with and without the ability to efficiently allocate risk. This framework is used to evaluate the effects of the allocation of risk on the relationship between an individual's valuation of change in the access conditions and the conventional measures of consumer surplus for certain changes in the amenity resources. The paper concludes by considering the implications of the results for efforts to estimate the values associated with changes in the availability of uncertain environmental amenities. (Baker-IVI)
W86-01685

Group 6A—Techniques Of Planning

HYDROPOWER'S NEWEST GENERATION,
H. Smallowitz.
Civil Engineering, Vol. 55, No. 8, p 46-49, August, 1985. 3 Fig.

Descriptors: *Water resources development, *Hydroelectric power, *Canals, Small hydropower, Planning, Dam construction, Dams, Enviromental effects, Hydroelectric plants.

The Great Falls, Paterson, NJ project is based on a system of canals constructed in the late 1700s to spur small industry in the fledgling US, and develop independence from the economy of Great Britain. While the mills and factories the canals once powered have long since closed, the waterways are still capable of producing 4900 to 11000 Kw. The city of Paterson hopes to make use of this energy source in the future. In North slope, Alaska, the Susitna project is actually made up of two major developments on the Susitna River, some 180 mi North and East of Anchorage. The Eldred L. Field Project, in Lowell, Massachusetts is on a canal system that dates back to 1792. Efforts to make use of this system in modern times necessitated making certain that historical and environmental factors were considered. In Bumcombe County, North Carolina, near Ashville, developers are bringing out of retirement an abandoned hydroelectric plant. The Craggy Dam was originally constructed in 1904. A proposal to tap electricity from the flow of water to Jersey City, New Jersey's water taps is beset with regulatory problems. Plans call for two small hydroplants to be installed at the Boonton Reservoir, 25 mi west of the city. An innovative use of existing mud gates in the reservoir will also make it cost effective to generate 2 Mw more from the facility. (Baker-IVI)
W86-01739

COMPUTER KEEPS NEW ORLEANS' HEAD ABOVE WATER,
Daniel, Mann, Johnson and Mendenhall, New Orleans, LA.
M. A. Ports.
Civil Engineering, Vol, 55, No. 8, p 56-58, August, 1985. 1 Fig.

Descriptors: *Drainage control, *New Orleans, *Louisiana, *Computers, *Drainage systems, Data handling, Storm runoff, Canals, Simulation, Flood peak, Pumping rate.

Drainage problems have beset the city of New Orleans, Louisiana since its founding in 1718. By 1983 it was apparent that an adequate drainage system was necessary. The survey of the topography of the city revealed that the city is saucer shaped. A plan to lift storm water up and out of the city called for an extensive network of canals and pumping stations to Lake Pontchartrain and Lake Borgne. In order to simulate successfully the complex network of interconnected open and covered canals, conduits and pumping stations under both surcharged and free flowing conditions, any potential model must be capable of predicting for each area, for any storm, the time and elevation of peak flows, the maximum pumping rates required to handle peak flows, the above ground flood slopes and the time needed to pump away storm-water runoff. Designers worked to plan the most effective and cost effective improvements. The models for each area were formulated only after testing hundreds of trial simulations. Without the aid of an in-house minicomputer, such a vast array of data would not have been processed with more than 800 simulations completed in only 15 months. (Baker-IVI)
W86-01740

TWO PROJECTS BECOME ONE,
Bureau of Reclamation, Durango, CO.
W. M. Roche, and J. W. Davison.
Civil Engineering, Vol. 55, No. 8, p 64-65, August, 1985. 2 Fig.

Descriptors: *Water resources development, *Multipurpose projects, *Dolores Project, *McElmo Project, *Colorado, Salinity control, Water management, Water supply development, Canals, Linings.

The Dolores and McElmo projects, both near Cortez, Colorado, were begun at different times. The Dolores Project, located in the Dolores and San Juan River Basins was set up to develop water from the Dolores River for municipal, industrial, and irrigation supplies; power; food control; and fish, wildlife and recreation. Just south of the Dolores Project at the McElmo Unit sites, studies were underway to determine the most cost-efficient alternative for reducing salt concentrations. Once preliminary investigations showed that creating a $34 million McElmo Unit that was separate from the Dolores Project would be inefficient, representatives from both projects met to discuss possible joint efforts. The combined project calls for enlarging and lining the Lower Hermana Lateral and Highline Ditch to handle the flows of Towaoc and Rocky Ford canals. Depending on soil conditions and right of way restrictions, either earth, concrete or plastic membrane lining will be used. Design for other portions of the project including canal enlargement and salinity control, will be completed in stages. (Baker-IVI)
W86-01741

PROBABILITY DISTRIBUTION MEMBERS OF A RANKED SAMPLE,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
L. D. Ratkovich.
Water Resources, Vol. 11, No. 3, p 179-185, May-June, 1984. 2 Fig, 3 Tab, 8 Ref. Translated from Vodnye Resursy, No. 3, p 15-22, May-June, 1984.

Descriptors: *Probability distribution, *Autocorrelation, *Time series analysis, Hydrology, Geophysics, Water management,.

When performing hydrologic and water management calculations, it is often necessary to estimate the probability of a particular member of a time series composed of geophysical quantities. The presence of autocorrelation of water-balance components in time series has been proven. Problems remain as to what probabilities the ordinates of a ranked sample of correlated quantities should be referred and what random errors can occur in the case. For a series length of more than 30 members the effect of autocorrelation on the estimates of empirical probabilities of a ranked sample is not evident. Even in this case, when the values of the autocorrelation coefficient are high, the effect of autocorrelation is comparable to the difference between the probabilities calculated by given equations. An equation is also provided for giving a sample estimate of probability with consideration of autocorrelation and is recommended for small samples. Further investigation should be geared toward a theoretical analysis of the distributions of the sample estimates of probabilities of correlated samples and, in particular, a refinement of the confidence limits. Of definite interest is an analysis of the effect of autocorrelation on errors in the estimates of the random variable itself on the basis of the calculated probability values. (Baker-IVI)
W86-01817

6B. Evaluation Process

LOWER MAE PING PROJECT, THAILAND,
Crippen International Ltd., Vancouver (British Columbia).
G. D. A. Akins, P. R. Blinch, and P. Premchun.
Water International, Vol. 10, No. 2, p 52-56, June, 1985. 2 Fig, 2 Ref.

Descriptors: *Lower Mae Ping Project, *Thailand, *Hydroelectric plants, Water resources development, Economic aspects, Design criteria, Water management, Pumped storage, Diversions, Flood control.

The Lower Mae Ping Project was designed to provide more hydropower generating capacity to the power system of Thailand, while increasing the volume of water available for irrigation in the dry season. This will be achieved through installation of a reversible pump/turbine at Bhumibol, an existing hydropower dam, construction of a low head hydropower scheme downstream of the da
diversion of flows towards these facilities f
adjacent river. Technical features of the
are outlined. Principal design constraints
system include an affect on the EGAT
system, downstream water availability a
flood control function of Bhumibol dam. E
mental and social aspects are briefly note
with benefits, costs, and scale of the proje
ondary benefits will include local irrigation
control, and inland fishery development.
IVI)
W86-01374

**GROUNDWATER IN WATER RESOU
PLANNING: CONJUNCTIVE USE,**
Universidad Politecnica de Valencia (Spain)
For primary bibliographic entry see Field 4
W86-01375

**NIGERIAN WATER RESOURCES AND
MANAGEMENT,**
Nigeria Univ., Nsukka. Dept. of Civil Engi
G. U. Ojiako.
Water International, Vol. 1, No. 2, p 64-7
1985. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Nigeria, *Water resources d
ment, *Developing countries, Water mana
Decision making, Planning, Water supply,
waters, Rainfall, Groundwater, Institution
straints.

The potentiality and management of the
resources of Nigeria are examined and
achievements of the authorities charged w
multi-purpose development of this resou
reviewed. The annual mean rainfall distu
ranges from about 157.5 inches at the c
practically zero at the northern border
average annual mean of 47.2 inches for the
country. Surface sources include the River
the third largest river in Africa. In additio
are also the River Benue, Cross River
Sokoto, Ogun, Anambra, and Kaduna Ri
gether with several streams and channels, la
ponds which provide a nationwide web o
age basins. The quantities of runoff from th
age basins vary widely and depend upon
number of factors the most important of wh
the amount and intensity of rainfall, the
and vegetation as well as geological, geogr
and topographical features of the area.
ground water reserves exist in numerous lo
all over the country and have been conserv
estimated as 30 times the level of surface
The establishment of River Basin Author
mains in Nigeria the greatest landmark mad
independence in the development of the ec
The accelerating agricultural activities of
thorities will return the country to its
position of an agricultural based economy
of earning substantial foreign exchange and
ing overdependence on oil exports. The p
which face the Basin Authorities and
reduce their pace of development, such as f
constraints in fundings, and insufficiency
quately trained technical and administrativ
power, can easily be overcome with the c
tion of developed countries and the good
international organizations. At home, the
the Authorities will be made easier with th
eration of local financial houses, local in
State Governments and organizations wit
ests in water development as well as institu
higher learning. (Baker-IVI)
W86-01376

**AGRICULTURAL BENEFITS FOR SE
RIVER BASIN,**
Army Engineer Battalion (79th), APO Ne
09360. Company B.
For primary bibliographic entry see Field 3
W86-01432

**BIG CHALLENGE OF SMALL WATE
TEMS,**
Pirnie (Malcolm), Inc., White Plains, NY.

elstad, and J. Bennett.
n City and County, Vol. 100. No. 2, p 34-
ebruary, 1985. 2 Fig.

ors: *Water conveyance, *Management,
, Decision making, Water management,
pply, Water treatment.

ater systems must accomplished their mis-
h very limited resources. Because their
e cannot justify constant attention, both
ent and operation are part time efforts.
all water systems are not economically
ften they may employ operators who are
id and lacking strong motivation or with-
per training and certification without
ge enough to cope with the complex pro-
the Safe Drinking Water Act. Thus these
re more likely to violate drinking water
. Among possible solutions to these prob-
nsolidation which can occur in a variety
small private utilities can merge into
ganizations or public agencies, usually at
y level, can take charge. Mergers and
are not the only way to achieve the
f a regional system. Another mechanism
perative agreement among water systems
esources and services. Management serv-
e shared also, enabling such functions as
g, maintenance, bookkeeping and billing
ralized. Avenues for technical assistance
ial assistance are briefly noted with some
given. (Baker-IV)
7

RD LAKE IN CORNWALL: FROM
ION TO UTILIZATION,
by, T. A. Johnston, and J. D. Evans.
the Institution of Water Engineers and
Vol. 39, No. 3, p 207-224, June, 1985. 9

s: *Clifford Lake, *England, *Reser-
ater supply development, Water re-
ater supply, Water demand, Dam con-
ish management.

investigations were made to determine
oute to take for meeting the water
the Cornwall River Authority area
ar 2001. The construction of Colliford
argest reservoir in Cornwall, fulfilled a
the water resource strategy thus devel-
total area to be supplied from Colliford
onjunction with existing sources of
unts to some 3,322 sq km. Early investi-
ruled out the possibility of the use of
r, desalination, an estuarial barrage, or
rage for water resource development.
provided of the site selection process
nstruction. Reinforced concrete struc-
bed include overflow works, draw-off
r, access gallery/overflow culvert, and
on gallery/cut-off. Construction of a
lam, Soimonstone Embankment, is also
The river Fowey is well known for its
sea trout fishing. To mitigate the loss
on due to the construction of the Colli-
a fish trap and fence have been built
iver immediately downstream of Colli-
with an adjoining fish hatchery. Im-
gan at the end of July 1983 and rainfall
o about 93% of the 15 year average
first year. Drought occurred in the
1984. During the early months, dis-
he St. Neot river were mainly limited
ensation flow of 5.7 Ml/d. However,
ght made itself felt, augmentation dis-
re made. Prior to the augmentation
perature and dissolved oxygen moni-
ndicated that the lake was becoming
ratified and there was oxygen deficien-
ver levels. The concentrations of iron,
ammoniacal nitrogen and hydrogen
also increased in the deeper water
algal productivity was low. Thus, in
the aeration compressor was used
and it ran continuously during Sep-
seemed to be effective in mixing, re-
and reducing the chemical concentra-
water, although more experience will
establish guidelines for economic use.

W86-01519

HOW TO PUT MORE PUBLIC INTO PUBLIC WORKS,
Black and Veatch, Kansas City, MO.
T. E. Decker, and L. J. Saiger.
Journal of the Water Pollution Control Federation, Vol. 57, No. 7, p 756-762, July, 1985. 4 Fig.

Descriptors: *Public relations, *Education, Public participation, Public opinion, Attitudes, Utilities, Wastewater facilities, Water supply development.

A detailed list is presented of public involvement and education activities and methods that can be used to promote the acceptance of public works facilities, including wastewater and water supply facilities. A brief overview is given of a public participation program for their facilities plan demonstrated that a designed, comprehensive public campaign using standard activities can be successful in many instances. Case histories clearly show that it is occasionally necessary to use very specialized and intensive public relations techniques to educate and satisfy the public. These two case histories prove that public education, involvement, and relations activities are very important at all stages of a project; that words, diagrams, and photographs are not always sufficient to educate individuals about the impact that public works facilities may have on their lives; that the willingness of a municipality or utility to commit money and take the time and effort needed to appease public concerns is usually rewarded; and that, if treated fairly, individuals will generally be willing to compromise and respond positively. The keys to fair treatment are compassion, honesty, imagination, generosity, and perseverance. (Baker-IVI)
W86-01542

SOUTHERN OCEAN AND MARINE POLLUTION: PROBLEMS AND PROSPECTS,
George Washington Univ., Washington, DC. Dept. of Political Science.
C. C. Joyner.
Case Western Reserve Journal of International Law, Vol. 17, No. 2, p 165-194, Spring, 1985. 174 Ref.

Descriptors: *Planning, *Water pollution control, *Marine pollution, *International law, Legal aspects, Marine sediments, Oceans, Natural resources development, Antarctic region.

The nature of marine pollution is examined as it has come to affect global ocean space. An assessment is provided of the extent to which pollutant contamination is presently encroaching upon the Southern Ocean's ecosystem, as well as the possible threates which potential hydrocarbon development in or around Antarctica would likely pose for the circumpolar seas. Finally, an analysis is performed of the various international legal instruments which have been purposefully designed and implemented for curtailing marine pollution. In this connection, specific reference is made to the protection of the Antarctic maritime area. As a result of this analysis, hopefully the environmental degradation associated with marine pollution in the circumpolar region will be better understood and appreciated. More importantly, it is necessary to realize that new, viable, and effective international legal safeguards are imperative if the fragile ecosystem of the Southern Ocean is to be adequately protected and prudently managed. (Baker-IVI)
W86-01686

EVALUATING ALTERNATIVE INVESTMENT PROGRAMS FOR THE MEDITERRANEAN-DEAD SEA PROJECT,
Mediterranean-Dead Sea Co. Ltd., Jerusalem (Israel).
A. Gross, and J. Zahavi.
Water Resources Research, Vol. 21, No. 7, p 905-916, July, 1985. 7 Fig, 29 Ref, 1 Append.

Descriptors: *Israel, *Mediterranean-Dead Sea Project, *Evaluation, *Investment, Alternative planning, Optimization, Hydroelectric plants, Economic feasibility, Canals, Tunnels.

The sharp difference in elevation between the Mediterranean and the Dead Sea and the need to replace the water withdrawn from the Dead Sea by water from another source are the key to ambitious Mediterranean-Dead Sea (MDS) project. This project is intended to convey water from the Mediterranean to the Dead Sea via canals and tunnels utilizing the height difference of close to 400 m to generate hydroelectric energy. A methodology, geared toward the prefeasibility study, is devised for evaluating alternative investment programs in the MDS project, which is based on comparing the optimal configuration for each alternative route of the water carrier. The maximal energetic benefits are calculated using two interrelated optimization problems: a multiperiod optimization, involving dynamic programming, to find the optimal operating regime of the system over time, and a one-period optimization, imbedded in the multiperiod optimization, involving probabilistic methods, to find the loading point of the hydro unit that maximizes the value of the energy displaced. Cost-benefit analysis is used to find the optimal size of the hydroelectric components, including the hydro unit size and the water carrier diameter. The model has been applied to evaluate the economic feasibility of the MDS project and to rank the various alternatives by economic merit. The results of this study indicate that the MDS project is viable in all its alternatives with the Central project yielding the largest net benefits. Because the Central alignment introduces many other problems, mainly hydrological, it has been abandoned in favor of the next most economical plan, the Southern alignment. (Moore-IVI)
W86-01761

HYPERGAME ANALYSIS OF THE LAKE BIWA CONFLICT,
Tottori Univ. (Japan). Dept. of Civil Engineering.
N. Okada, K. W. Hipel, and Y. Oka.
Water Resources Research, Vol. 21, No. 7, p 917-926, July, 1985. 1 Fig, 6 Tab, 29 Ref.

Descriptors: *Lake Biwa, *Japan, *Hypergame analysis, *Water allocation, Model studies, Water management, Resource management, Conflict analysis, Decision making.

When there are misunderstandings among participants in a water resources conflict, hypergame analysis can be used to systematically model the conflict and predict the compromise resolutions. In order to demonstrate the efficacy of using hypergame analysis for studying water resources management problems, it is applied to the Lake Biwa conflict in Japan. This dispute constitutes a typical example of a water allocation conflict where downstream users would like more water from the upstream controllers of the major source of the water. Furthermore, each participant or player in the Lake Biwa dispute has misperceptions about the other players' preferences. Besides predicting the different resolutions which each of the players envisioned, hypergame analysis correctly forecasts the compromise resolution that occurred historically. (Author's abstract)
W86-01762

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

NEW IDEAS RESHAPING TREATMENT TECHNOLOGIES,
For primary bibliographic entry see Field 5D.
W86-01490

QUESTION OF RATES,
Consumers/Pirnie Utility Services Co., Inc., Hamden, CT.
H. F. Hanson.
American City and County, Vol. 100, No. 6, p 38, 40, 42, June, 1985.

Descriptors: *Economic aspects, *Water rates, Metering, Planning, Management, Utilities, Financing.

Through the years, water utilities have supplied treated water to their customers at the lowest cost, consistent with quality and reliability requirements. This approach has sometimes caused water utilities to become victims of their own success when customers began taking for granted the dependable flow of water at what some consider artificially low prices. Customers and utilities alike are now confronted with the lasting results of this practice. The capital assets of utilities are long-lived, remaining in service for 50 years or more. The initial investments made in the 1930s have not generated sufficient depreciation in funds to finance the replacement or expansion required at today's high construction costs. Suburban expansion of older cities means that more customers must be provided with water over greater distances. New or expanded facilities often must be built to meet expected growth before the customers are in place to pay for service. Two chief problems face water utility managers: how to raise capital, and how to obtain higher rates to pay for the needed improvements. One alternative is the imposition of system development revenues, such as connection fees or cost-of-service charges. Demand rates for utility systems have also received consideration. An emerging technology that will enable utilities to monitor customers' consumption accurately on a frequent basis is automated meter reading. (Baker-IVI)
W86-01491

EFFLUENT REGULATION AND LONG-RUN OPTIMALITY,
University of Southern California, Los Angeles. Dept. of Economics.
For primary bibliographic entry see Field 6E.
W86-01684

PAYING FOR REUSE WATER,
CH2M Hill, Inc., Portland, OR. Water and Wastewater Economics.
C. W. Corssmit.
Journal of American Water Works Association, p 78-83, July, 1985. 2 Fig, 1 Tab.

Descriptors: *Water reuse, *Pricing, Cost allocation, Cost-benefit analysis, Water demand, Financial feasibility.

To arrive at satisfactory financing plans and price schedules for reuse water, economic feasibility studies of the proposed projects, including consideration of the no-action alternative, should be undertaken before engaging in more traditional financial planning. This helps to determine the benefits and costs and a proper framework for cost allocations. A market analysis should also be performed to make sure there is a demand for reuse water and to determine what prices people would be willing to pay for it. Typically, revenues obtained from sales of reuse water will be less than for potable water and would possibly not be equal to the cost of serving reuse customers. Methods for redistributing the deficits to other water users are suggested. (Author's abstract)
W86-01745

CONSERVATION USING A RATE OF RETURN DECISION RULE: SOME EXAMPLES FROM CALIFORNIA MUNICIPAL WATER DEPARTMENTS,
California Univ., Santa Barbara. Dept. of Economics.
For primary bibliographic entry see Field 3D.
W86-01763

VOLUMETRIC PRICING OF AGRICULTURAL WATER SUPPLIES: A CASE STUDY,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
R. C. Griffin, and G. M. Perry.
Water Resources Research, Vol. 21, No. 7, p 944-950, July, 1985. 5 Tab, 17 Ref.

Descriptors: *Volumetric pricing, *Irrigation water, *Rice, *Texas, Consumptive use, Econometric models, Economic aspects, Model studies, Pricing.

Models of water consumption by rice producers are conceptualized and then estimated using cross-sectional time series data obtained from 16 Texas canal operators for the years 1977-1982. Two alternative econometric models demonstrate that both volumetric and flat rate water charges are strongly and inversely related to agricultural water consumption. Nonprice conservation incentives accompanying flat rates are hypothesized to explain the negative correlation of flat rate charges and water consumption. Application of the results suggests that water supply organizations in the sample population converting to volumetric pricing will generally reduce water consumption. (Author's abstract)
W86-01766

6D. Water Demand

NILE INSIDE THE SUDAN - INCREASING DEMANDS AND THEIR CONSEQUENCES,
King Saud Univ., Riyadh (Saudi Arabia). Coll. of Engineering.
A. M. A. Salih.
Water International, Vol. 10, No. 2, p 73-78, June, 1985. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Water resources development, *Water demand, *Nile River, *Sudan, Decision making, Management, Water quality control, Irrigation water, Water management, Environmental effects.

Water budgets of the Nile and its major tributaries have been reviewed and compared with changes in the rate of water abstraction for irrigation purposes in the period starting from Sudan's independence in 1956 to the medium range future. Considerable quantities of the Nile's average annual water budget were to be abstracted for irrigation schemes inside the Sudan in 1977. The effects of these vast abstractions are especially felt, during the low flow season, along many reaches of the Nile and its major tributaries. These abstractions reached 64% of the Blue Nile's average flow during the eight months of the low flow season in 1977. Due to a trend in water use, these effects are expected to worsen in the short and medium term future. Numerous harmful consequences result from these heavy water abstractions, including the neglected rights of the downstream population and the environmental hazards. Reservoir compensation ordinances have existed since 1937 and an Environmental Health Ordinance was issued in 1975. If these ordinances were strictly applied, many consequences would have been reduced or eliminated. Unfortunately these ordinances cannot be effectively implemented due to a lack of monitoring and operational capabilities. They must form an integral part of a comprehensive national water resources management plan. (Baker-IVI)
W86-01377

ETHIOPIAN INTERESTS IN THE DIVISION OF THE NILE RIVER WATERS,
Sanje Zivanovica 9, Belgrade, Yugoslavia.
D. Jovanovic.
Water International, Vol. 10, No. 2, p 82-85, June, 1985. 1 Fig, 1 Tab.

Descriptors: *Nile River, *Ethiopia, *Egypt, *Sudan, *Kenya, *Water demand, Water supply development, Irrigation water, Water resources development, Blue Nile, White Nile, Water management.

The main tributaries of the Nile River are the Blue Nile and the White Nile. The source and nearly the entire catchment area of the Blue Nile are in Ethiopia, while the White Nile basin is shared by several countries. The Nile Water is being used for irrigation, hydropower production, domestic and industrial water supply, navigation, as well as for other purposes. It is likely that Ethiopia will claim about 40 x 10 to the 9th power cu m of Nile water for irrigation. The Nile flow through Sudan and Egypt will be reduced by the same water quantity. Similarly, but on a smaller scale, water used for irrigation in Uganda, Kenya and Tanzania would reduce the White Nile flow. The gain in water after possible reclamation of the Sud and swampy areas also needs to be taken into a Sudan and particularly Egypt need all the they can get and are highly dependent water claimed by the other countries in Obviously a compromise needs to be fou cause if upstream countries maximally satis needs, this could have severe implicatio Sudan and particularly Egypt. It seems t that satisfactory agreement can be achieve near future between all the parties invol order to develop criteria to be used for water division, all countries need to prepare that justify their water demands. Preli agreement on the size, accuracy and standa these studies are needed in order to mak comparable. (Baker-IVI)
W86-01379

TRADING 404 PERMITS FOR ENHA FISH HABITAT,
For primary bibliographic entry see Fie
W86-01681

MEASURING VALUES FOR ENVIRO TAL RESOURCES UNDER UNCERTAIN
New South Wales Univ., Kensington (Au School of Economics.
For primary bibliographic entry see Field 6.
W86-01685

WINNING THE WAR AGAINST UNACC ED FOR WATER,
Pitometer Associates, Upper Montclair, NJ.
M. Siedler.
Journal of the New England Water Work ciation, Vol. 99, No. 2, p 119-135, June

Descriptors: *Water distribution, *Mon *Metering, Water use, Water demand, Wat veyance, Water audit, Leakage.

An efficiently designed, operated and mai water distribution system will save money utility and its ratepayers. The do it yoursel audit method involves the performance o improvement water audit, which is aimed a ing the problem by the use of per capit consumption data. In order to work th through the process, the water system mu available the following information: accura production figures showing the gross vol water delivered to the system, two ways t mine total water sold to residential custome total residential population served by the and true per captia residential consumption benchmark data are established for the rep tive sub network, the information can be determine if the unaccounted for water p for the total network is caused by leakag under registration of domestic meters. W determine the extent of a metering probl considered. (Baker-IVI)
W86-01751

HYPERGAME ANALYSIS OF THE BIWA CONFLICT,
Tottori Univ. (Japan). Dept. of Civil Engi
For primary bibliographic entry see Field 6
W86-01762

MUNICIPAL WATER DEMAND S OKLAHOMA CITY AND TULSA, OKLA
Oklahoma Water Resources Board, Ok City.
R. Cochran, and A. W. Cotton.
Water Resources Research, Vol. 21, No. 7, 943, July, 1985. 2 Tab, 13 Ref, 2 Append.

Descriptors: *Water demand, *Oklahom *Tulsa, *Oklahoma, Income, Price, Precip Air temperature, Municipal water, Household

Although population is an important vari forecasting future water demands, it does count for all of the variation in quantity dem multiple regression model was used to stu

which influence water consumption in a City and Tulsa, Oklahoma during the eriod of 1961 through 1980. The explana- ables utilized in the model include the rice of water per thousand liters; constant income; average monthly precipitation in millimeters; average monthly tempera- ; and number of households per thousand n. Whether considered alone or included r variables, the income factor was always be a significant determinant of water Although price was significant in each used alone, it did not have as high a value as income and was not found to ant in Tulsa when joined to other varia- consistent decline of real average price of oth cities over a 20-yr period should be a single explanatory variable for Tulsa, r of households per thousand popula- found to be as significant and as highly to water consumption as per capita Oklahoma City the statistic relating to was significant, though not as highly as other factors. Environmental factors ound to be correlated to water use. This rtly due to the inability to separate the sses of water users within the category ter use. (Moore-IVI)

ter Law and Institutions

DAKOTA GARRISON DIVERSION AND INTERNATIONAL ENVIRON- LAW,
Univ. (Scotland).
ell.
ota Law Review, Vol. 60, No. 4, p 603- 08 Ref.

*North Dakota, *Garrison Diversion nternational law, *Canada, Legal as- r resources development, Diversions, y development.

n Diversion Unit (GDU) will divert the lake formed by Garrison Dam and wea to central and southeastern North project is primarily intended to pro- entary water supplies to 14 communi- dustrial areas and to provide for fish conservation, recreation, and flood thermore, 250,000 acres are to be irri- diverted waters. The GDU project pposition based primarily on environ- derations. On the whole, during this national law has been neglected even vironmental concepts are relevant to ent of North Dakota's water project. ew of the Garrison Diversion history nd the Canadian environmental objec- overview is presented of two aspects al law. First, substantive international l law is inspected. Second, a survey is rnational procedural law relevant to aving possible harmful effects of an drainage basin. The conformity of the with this substantive and procedural ed. (Baker-IVI)

ND WATER COURSES - TORTS - F PROPERTY DAMAGED BY UN- ITCHING OR UNREASONABLE OF WATERS MAY OBTAIN STATUTE OR BY THE TORT F REASONABLE USE,
ck.
Law Review, Vol. 60, No. 4, p 741- Ref.

*Water law, *Drainage, *North ts, *Reasonable use, Legal aspects, Surface waters, Civil law.

vners in LaMoure County construct- drainage ditches from the numerous soughs, and depressions on their 1967 and 1974. This activity caused it in a natural depression on plaintiff Young's land, causing, he charged, damage to his crops and farmland and decreasing the value of his farming operations. Three doctrines of surface water law are applicable. The oldest is civil law rule, which states that the owner of the highland or dominant estate has a natural easement or servitude in the low lying or servient estate, allowing the owner of the dominant estate to discharge all natural waters flowing or accumulating upon his land onto the land of the servient owner. The common enemy rule of surface water suggests a landowner may deal with surface water as he sees fit regardless of the effect on adjoining land. The common enemy rule encourages the full use and exploitation of land. A major flaw is that it forces adjoining landowners to bear the burden of surface water expulsion rather than the landowners who undertake the improvement projects. The reasonable use rule sets forth well defined guidelines including determinations of whether reasonable necessity requires the drainage and balancing the burden against the benefit of the drainage. As this particular case came to trial, it was noted that the plaintiff constructed dams on his own land, thus reducing the gravity of the harm. The trial court denied Young relief because his self-help measures were not legal under section 61-01-07. Moreover, the trial court stated that these self help measures in building dams also precluded Young from recovering under the reasonable use rule. The North Dakota Supreme Court stated that the statements of the trial court were based on an erroneous conception of the reasonable use doctrine. The court also noted that reasonable use should not be confused with negligence or contributory negligence. (Baker-IVI)
W86-01683

EFFLUENT REGULATION AND LONG-RUN OPTIMALITY,
University of Southern California, Los Angeles. Dept. of Economics.
D. F. Spulber.
Journal of Environmental Economics and Management, Vol. 12, No. 2, p 103-116, June, 1985. 1 Fig, 18 Ref.

Descriptors: *Public policy, *Regulations, *Effluents, Standards, Water pollution control, Economic aspects.

A regulator faced with free entry of firms is concerned not only with the implications of public policy for the discharges from a representative firm but also with the total pollution observed at the long run market equilibrium. The long run efficiency properties of regulatory instruments are examined in a multiple input framework. The effluent tax and tradeable permit are shown to be efficient with free entry and exit of small firms. The across-the-board effluent standard results in excessive entry and excessive industry pollution. The results of the study indicate the importance of directing public policy toward pricing the use of the environment. The policy instruments which achieve long run optimality in a competitive market with small firms are the effluent tax and the tradeable effluent permit. Direct intervention through output taxes or output controls, entry tariffs, or restrictions, or effluent constraints will create further distortions in the allocation of resources. Given an effluent charge or permit price equal to marginal social damages, the total of firm payments equals the sum of environmental rent and external damages. These two components provide optimal incentives for entry in the long run. (Baker-IVI)
W86-01684

MEASURING VALUES FOR ENVIRONMENTAL RESOURCES UNDER UNCERTAINTY,
New South Wales Univ., Kensington (Australia). School of Economics.
For primary bibliographic entry see Field 6A.
W86-01685

SOUTHERN OCEAN AND MARINE POLLUTION: PROBLEMS AND PROSPECTS,
George Washington Univ., Washington, DC. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W86-01686

KEEP YOUR POLLUTION TO YOURSELF: INSTITUTIONS FOR REGULATING TRANSBOUNDARY POLLUTION AND THE UNITED STATES-MEXICO APPROACH,
N. Glickman.
Virginia Journal of International Law, Vol. 25, No. 3, p 693-727, Spring, 1985. 188 Ref.

Descriptors: *Water pollution control, *International law, *United States, *Mexico, Water quality control, Water resources, Legal aspects, International agreements.

The variety of approaches to the control of transboundary pollution that have been tried around the world suggests that there is no simple solution to the ever-increasing international pollution problem. Nevertheless, the willingness of many countries to experiment with novel regulatory schemes bodes well for the future. Although the international law in this area is currently underdeveloped, as more countries submit themselves to specific and enforceable agreements there may well develop a body of customary international environmental law binding on all countries. Until that happens, however, transboundary pollution control will come about only through international agreement. A consideration of the different European and North American approaches to pollution regulation yields several important conclusions. First, that so many countries are beginning to involve themselves in transboundary pollution control represents a positive step in the effort to preserve and protect global natural resources. Second, the wide range of agreements signed in the past twenty years suggests an increasing awareness by the international community that pollution regulation should prevent disasters and not just respond to then. Third, the most effective agreements have been those that either specifically address a narrow problem, or provide a general framework for cooperation and establish procedures whereby the parties can develop solutions to narrow problems as they arise. (Baker-IVI)
W86-01688

HAZARDOUS WASTE CLEANUP: THE PRELIMINARIES,
Environmental Protection Agency, New York. Region II.
For primary bibliographic entry see Field 5G.
W86-01738

LAW OF THE COAST IN A CLAMSHELL; PART XIV: THE MARYLAND APPROACH,
San Francisco, California.
P. H. F. Graber.
Shore and Beach, Vol. 52, No. 1, p 3-10, January, 1984. 1 Fig, 94 Ref.

Descriptors: *Coastal waters, *Water rights, *Legal aspects, *Maryland, Public rights, Public access, Uplands, Tidal waters, Navigation, Erosion, Littoral zone.

As defined in the Maryland Coastal Management Program, the state's coastal zone embraces Baltimore City and 16 counties bordering the Atlantic Ocean, Chesapeake Bay and the Potomac River upstream from Washington, D.C. Coastal zone lands may be divided into uplands, tidelands and submerged lands. With some qualifications, Maryland follows the usual rule that property boundaries of lands adjoining tidal waters shift with those gradual, imperceptible physical changes termed accretion and erosion. Unlike courts in other coastal states, the Maryland Court of Appeals has not expansively applied the public trust doctrine, the concept dealing with the public's rights of navigation and fishing in tidal waters. However, the state's high court has recognized public rights in tide covered lands. Public access rights, private littoral rights, and the leasing and regulation of coastal zone lands and waters as currently practiced in Maryland are discussed. (Baker-IVI)

W86-01829

LAW OF THE COAST IN A CLAMSHELL; PART X: THE NORTH CAROLINA APPROACH,
California Dept. of Justice, San Francisco. Office of the Attorney General.
For primary bibliographic entry see Field 2L.
W86-01833

LAW OF THE COAST IN A CLAMSHELL; PART XV: THE SOUTH CAROLINA APPROACH,
For primary bibliographic entry see Field 2L.
W86-01836

LAW OF THE COAST IN A CLAMSHELL; PART XVI: THE MAINE APPROACH,
For primary bibliographic entry see Field 2L.
W86-01838

LAW OF THE COAST IN A CLAMSHELL; PART XVII: THE CONNECTICUT APPROACH,
For primary bibliographic entry see Field 2L.
W86-01840

LAW OF THE COAST IN A CLAMSHELL; PART XVIII: THE VIRGINIA APPROACH,
For primary bibliographic entry see Field 2L.
W86-01842

6F. Nonstructural Alternatives

GOVERNMENT SUBSIDIES FOR POLLUTION CONTROL INVESTMENTS - DO OTHER COUNTRIES ENJOY AN UNFAIR ADVANTAGE,
Environmental Resources Ltd., London (England).
R. Bidwell.
Chemistry and Industry, Vol. 85, No. 12, p 395-402, June, 1985. 2 Fig, 6 Tab, 3 Ref.

Descriptors: *Water pollution control, *Political aspects, *Investment, Economic aspects, Subsidies, Industries, Costs, Taxes.

A study was conducted to survey and assess the extent to which government subsidies are made available to industry for pollution control investments in selected countries; to assess the impact that these subsidies have on the net cost to industry of pollution control investments; to assess the extent to which the subsidy schemes conform to the European Community recommendation of 1975; taking account of possible financial assistance, and to determine whether there is evidence that environmental subsidies significantly distort competition. The study identified 36 schemes which might be used to assist industry with pollution control investments. Twenty-eight of these were specifically designed to provide aid for pollution control investments. Four of the schemes focus on particular industry sectors or groups of firms; a number of the schemes focus on particular geographical areas. Eight of the schemes identify research and development as one of their objectives or as their principal objective. Eight schemes were identified that provided general investment aid. These are schemes such as the UK regional allowance or general investment tax allowances that could be used to benefit industrial pollution control investments but which are not specifically designed for that purpose. Pollution subsidies available in the four continental European countries studied, The Netherlands, Italy, Germany, and France, in most cases were designed to assist existing firms with the investment cost of their pollution control plants. The UK does not offer environmental aid of this type. It does make available tax allowances on new investment amounting to around 14%. These environmental assistance schemes are undoubtedly of considerable benefit to firms required to comply with pollution control measures. (Baker-IVI)
W86-01612

6G. Ecologic Impact Of Water Development

FACTORS INFLUENCING THE SALINITY REGIME OF LAKE PONTCHARTRAIN, LOUSISANA, A SHALLOW COASTAL LAGOON: ANALYSIS OF A LONG-TERM DATA SET,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
W. B. Sikora, and B. Kjerfve.
Estuaries, Vol. 8, No. 2A, p 170-180, June, 1985. 9 Fig, 2 Tab, 15 Ref.

Descriptors: *Lake Pontchartrain, *Louisiana, *Salinity, *Canals, Water resources development, Environmental effects, Flow discharge, Lagoons.

Lake Pontchartrain is a brackish water lagoon in southeastern Louisiana. Numerous chemical and physical changes have resulted in this region due to the expansion of the city of New Orleans. The greatest potential for change in the lake arose from the completion of the Mississippi River-Gulf Outlet deep water canal in 1963. While a large increase in salinity of the lake waters was expected, less than half the expected increase actually occurred. The most important factor controlling salinity variations in the lake is discharge. Seventy-four percent of low frequency salinity variations are explained by freshwater discharge and the completion of the deep water canal. Annual variations of salinity are somewhat high in the lake. There has been a die back of freshwater swamps and a retreat of lagoon shorelines, but these are not felt to be a result of the deep water canal completion. (Baker-IVI)
W86-01335

NILE INSIDE THE SUDAN - INCREASING DEMANDS AND THEIR CONSEQUENCES,
King Saud Univ., Riyadh (Saudi Arabia). Coll. of Engineering.
For primary bibliographic entry see Field 6D.
W86-01377

CHEMICAL ZONATION IN GROUNDWATER OF THE CENTRAL PLAINS, CANTERBURY,
North Canterbury Catchment Board, Christchurch (New Zealand).
For primary bibliographic entry see Field 5B.
W86-01387

IMPACT OF RIVER CHANNELIZATION; IV. THE ECOLOGICAL EFFECTS OF CHANNELIZATION,
Welsh Water Authority, Nelson. South East District.
M. P. Brooker.
Geographical Journal, Vol. 151, No. 1, p 63-69, March, 1985. 1 Fig, 56 Ref.

Descriptors: *Channeling, *Environmental effects, *Rivers, *United Kingdom, *Channelization, Wildlife, Vegetation, Fish, Invertebrates, Birds.

River corridors (the channel and the immediate local environment) form one of the major linear habitats in the United Kingdom and sustain important wildlife resources. Channelization can result in changes which effect the in-stream and bankside ecology. In general, fish populations are severely affected by channelization, natural channels supporting higher densities, greater biomass and more species, and any recovery is usually slow. The response of macroinvertebrates to channelization is variable but recovery is often rapid. Aquatic vegetation forms an intimate part of the ecology of rivers and streams yet the effects of channalization on in-stream vegetation are poorly documented. Channelization often devastates bankside tree and ground cover. Channelization has a direct impact on riverine birds and, where such works are related to land drainage schemes, changes in water status of the catchment and subsequent land use substantially reduce areas available to breeding and wintering wetland birds. There is a need to describe, more fully, wildlife resources in river corridors, both instream and bankside, and to e their relationships with habitat features in o provide scientifically robust management mendations designed to mitigate the effe channelization. (Baker-IVI)
W86-01404

EFFECTS OF DREDGING OPERATION NUTRIENT AND SUSPENDED SEDI CONCENTRATIONS,
Army Engineer District, New York.
For primary bibliographic entry see Field 5E
W86-01563

LAKE GREVELINGEN: FROM AN EST TO A SALINE LAKE. AN INTRODUC
Ministry of Transport and Public Works, burg (Netherlands). Environmental Researc
B. A. Bannink, and J. H. M. Van der Meulen
Netherlands Journal of Sea Research, Vol. 3/4, p 179-190, December, 1984. 4 Fig, 3 Ref.

Descriptors: *Ecosystems, *Saline lakes, Grevelingen, *Netherlands, Water quality, ronmental effects, Water resources develo Eutrophication, Nutrients, Algae, Denitrifi

In 1972 an ecosystem study was started, aiming at an analysis of the cycle of organic in the new evolving saline Lake Grevelin former estuary, closed for reasons of flood tion in 1971. The changing environmental tions are described. Nitrogen and silica app limit phytoplankton primary production. petitive interaction for nutrients between plankton and microphytobenthos has been lated. Nitrogen appeared to be the key facto aquatic system, assuming a denitrification r to 4 g N/sq m/a. Long term observations a slow eutrophication process during the 1977-1980. Studies on population dynam dominant species and food-chain dynamics a changing aquatic ecosystem with low pred ity. (Baker-IVI)
W86-01567

PHYTOPLANKTON AND NUTRIENT NAMICS IN SALINE LAKE GREVELI (SW NETHERLANDS) UNDER DIFFE HYDRODYNAMICAL CONDITIONS IN 1980,
Delta Inst. for Hydrobiological Research, (Netherlands).
C. Bakker, and I. De Vries.
Netherlands Journal of Sea Research, Vol. 3/4, p 191-220, December, 1984. 11 Fig, 3 Ref.

Descriptors: *Phytoplankton, *Nutrients, * dynamics, *Lake Grevelingen, *Nethe Saline lakes, Silicon, Nitrogen, Primary pro ity, Estuarine environment, Biomass, Flag Seasonal variation.

Hydrographical and phytoplankton bioma rameters were studied in Lake Grevelingen, ing the period of 1978-80. Clear salinity str tions were observed during periods of f with North Sea water. This phenonenon companied by strong gradients of water te ture, oxygen content, pH, silicon- and amm concentration. High nutrient concentrations ed from release from the bottom sediments. stratified (water depth more than 4-5 m) tions, minimum silicon fluxes of more than Si/sq m/day were estimated. The phytopl assemblage of Lake Grevelingen represents poverished version of the neritic community Southern Bight of the North Sea and of th ern Scheldt estuary. In summer it consists of diatoms; some flagellates dominate in The availability of silicon in spring was no lated with the increase of planktonic bioma cause cryptomonad flagellates dominated that period. The phytoplankton biomass ma been limited by silicon and nitrogen summer. Some diatom species changed the phological appearance, showing a more d

in Lake Grevelingen than in the tidal
f the Eastern Scheldt. The hydrodynamic
n Lake Grevelingen, as a consequence of
ioning of the sluice in the closing dam
North Sea, markedly influenced the envi-
l factors controlling species composition,
nd productivity of the phytoplankton.
mi-stagnant conditions in 1980 biomass
clined strongly but primary productivity
to a higher level. This indicates that the
mpartment of the lake was still far from
e highly productive phytoplankton as-
growing under limiting nutrient condi-
mmer, was based on low biomass values
tly underwent rapid processes of elimi-
iomass. (Baker-IVI)

**T CYCLING AND ECOSYSTEM BE-
R IN A SALT-WATER LAKE,**
for Hydrobiological Research, Yerseke
ds).
y bibliographic entry see Field 2H.

**ANKTON PRIMARY PRODUCTION
KISH LAKE GREVELINGEN (SW
ANDS) DURING 1976-1981,**
for Hydrobiological Research, Yerseke
ls).
bibliographic entry see Field 2H.

**OF SEDIMENT DISTRIBUTION
IN LAKE GREVELINGEN, AN EN-
ESTUARY IN THE SW NETHER-**
or Hydrobiological Research, Yerseke
s).
bibliographic entry see Field 2H.

**-WATER EXCHANGE IN LAKE
GEN UNDER DIFFERENT ENVI-
AL CONDITIONS,**
or Hydrobiological Research, Yerseke
).
bibliographic entry see Field 2H.

**404 PERMITS FOR ENHANCED
AT,**
urces and Environment, Vol. 1, No.
nter, 1985.

*Negotiations, *Environmental ef-
resources development, *Bonneville
l Utah Project, Water supply devel-
ation, Water supply, Fisheries, Plan-
nental interrelations.

sy over the loss of fish habitat in the
it of the Central Utah Project has a
The plan report to Congress in 1964
development of about 315,000 acre ft
unicipal and industrial use and some
. Transbasin diversions proposed
the flows of nine streams resulting
fish habitat. The Army Corps of
iewed the permit application, and
sue a permit to construct the Vat
because of opposition from the
e, the Fish and Wildlife Service,
Utah Division of Wildlife Resources
cerns over the amount of water for
s. The repayment contract only al-
ry releases of 6,500 acre-ft of water,
st Service demanded annual releases
-ft of water, and fish and wildlife
ded that 44,000 acre-ft of water be
various parties finally entered into
tions. A compromise agreement was
would provide 44,000 acre-ft of
for stream fisheries during the con-
Strawberry Aqueduct and Collec-
fter Strawberry Reservoir is filled,
provides for 22,300 acre-ft of water

and an additional 15,800 acre-ft to be acquired or developed through conservation, modification of deliveries, and through the acquisition of existing water rights. The state and federal agencies agreed to use their resources to acquire an additional 22,100 acre-feet. As a result of the compromise the permits were issued, and the project has been allowed to go forward. (Baker-IVI)
W86-01681

WATER QUALITY EFFECTS OF CLEARCUTTING UPPER COASTAL PLAIN LOBLOLLY PINE PLANTATIONS,
Southern Forest Experiment Station, Oxford, MS. Forest Hydrology Lab.
D. C. McClurkin, P. D. Duffy, S. J. Ursic, and N. S. Nelson.
Journal of Environmental Quality, Vol. 14, No. 3, p 329-332, 1985. 3 Tab, 12 Ref.

Descriptors: *Clear-cutting, *Forest management, *Pine trees, *Water quality, *Environmental effects, *Tennessee, Nitrogen, Phosphorus, Potassium, Nutrients, Soil types.

The effect of clearcutting loblolly pine (Pinus taeda L.) on concentrations of sediment and nutrients in stormflows was studied on small cathchments near Lexington, TN. The plantation were established on eroded and abandoned agricultural lands with fragile soils. Soil series on the catchments include Lexington silt loam (fine-silty, mixed thermic Typic Paleudalfs), Providence silt loam (fine-silty, mixed, thermic Typic Fragiudalfs) and Ruston sandy loam (fine-loamy, silicious, thermic Typic Paleudults). Eight catchments (0.17-0.56 ha) were instrumented with flumes equipped with water stage recorders to measure stormwater and Coshocton wheel samplers to obtain integrated samples of the flow. Plantations on four catchments were clearcut; the other four were left as uncut controls. Stormflow samples were analyzed for sediment total Kjeldahl nitrogen (TKN) and total phosphorus (TP) and solution-phase TKN, TP, and potassium (K). Results indicated that a third or more of the TKN and two-thirds of the TP exported in stormflow from the catchments was via sediment. Solution-phase TKN and TP concentrations in storm-flow were similar on clearcut and control catchments. Solution K concentrations were consistently higher from clearcut catchments. Rainfall inputs of TKN, TP, and K exceeded stormflow losses. The study demonstrated that pine plantations established on fragile soils can be clearcut without significant impact on water quality if recommended practices are used. (Author's abstract)
W86-01705

CAN WE SAVE THE OGALLALA,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W86-01737

PERSISTENCE OF STREAM FISH ASSEMBLAGES: EFFECTS OF ENVIRONMENTAL CHANGE,
University of Southern Mississippi, Hattiesburg. Dept. of Biology.
S. T. Ross, W. J. Matthews, and A. A. Echelle.
American Naturalist, Vol. 126, No. 1, p 24-40, July, 1985. 3 Fig, 5 Tab, 60 Ref.

Descriptors: *Fish behavior, *Fish populations, *Environmental quality, *Brier Creek, *Oklahoma, Drought, Temperature effects, Water stress, Brier Creek, Oklahoma, Piney Creek, Arkansas.

Fish assemblage stability and persistence are contrasted in an intermittent, prairie-margin stream (Brier Creek, Oklahoma) and a permanent upland stream (Piney Creek, Arkansas). The duration of the study encompassed three to four turnovers in the populations of most of the species studied and a major environmental perturbation in Brier Creek. Knowledge of temporal stability and persistence of ecological communities is critical to an understanding of the importance of biotic interactions in the maintenance of community structure. Persistence, as indicated by present data, was high for both stream assemblages over approximately one decade. Assemblage stability, as determined from measures of abundance, indicated greater change in the overall fish fauna of Brier Creek than that of Piney Creek. Southeastern Oklahoma had a severe summer drought in 1980 resulting in heat death of fishes in Brier Creek. Although some species were transiently affected, the harsh summer did not have a lasting effect on the Brier Creek fish assemblage overall. Upstream stations subjected to regular summer drying showed greater variability in numerical species ranks within a characteristic suit of upstream species, compared with downstream stations. Station-level changes in both Piney and Brier creeks were significant in several cases, even though the overall fauna of the former did not change significantly in species-abundance ranks. Geographic scale may have had a major effect on the assessment of assemblage stability and persistence. In the absence of detailed knowledge of home ranges of component species, an assessment of assemblage stability should be based on at least several localities within a watershed. (Baker-IVI)
W86-01756

ABUNDANCE OF WEST INDIAN MANATEES (TRICHECHUS MANATUS) AROUND SELECTED FLORIDA POWER PLANTS FOLLOWING WINTER COLD FRONTS, 1982-1983,
Eckerd Coll., St. Petersburg, FL. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-01758

ECONOMIC AND CULTURAL CONSEQUENCES OF LAND LOSS IN LOUISIANA,
Nicholls State Univ., Thibodaux, LA. Dept. of Earth Science.
D. W. Davis.
Shore and Beach, Vol. 51, No. 4, p 30-39, October, 1983. 5 Fig, 71 Ref.

Descriptors: *Wetlands, *Erosion, *Louisiana, Economic aspects, Social aspects, Fishing, Hunting, Recreation, Land use, Farming, Oil industry, Environmental effects, Flood control structures, Drainage.

Louisiana's coastal zone is presently out of balance - a great natural catastrophe is occurring. Land is disappearing. For the entire Louisiana coast, marsh losses in 1980 exceeded 25,000 acres per year. Land building in the deltaic plain has been replaced by a projected rate of loss of approximately 40 sq mi/yr. The land that is eroding at a record rate is a result of sediment deposition associated with the Mississippi River. The construction of flood levees and the dredging of drainage, navigation, petroleum and logging canals upset the sedimentation balance, influence saltwater intrusion and disrupt the natural flow regimes. Landloss forces now supersede constructive forces, thus threatening the jobs, industries and lifestyles of people whose lives are tied directly or indirectly to the coast. Trapping (a multimillion dollar industry), fishing, shrimp harvesting, the oyster industry, menhaden landings, and even recreational use of the waters are threatened. Movement from agricultural ventures to oil industry along the coastal line has brought with it changes in the erosional aspect of the coastal lands. (Baker-IVI)
W86-01835

BIOLOGICAL IMPACTS ON BEACH REPLENISHMENT AND BORROWING,
Coastal Engineering Research Center, Fort Belvoir, VA.
E. J. Pullen, and S. M. Naqvi.
Shore and Beach, Vol. 51, No. 2, p 27-31, April, 1983. 1 Fig, 32 Ref.

Descriptors: *Shoreline, *Beach replenishment, *Environmental effects, Great Lakes, Sand, Benthic animals, Corals, Turtles, Habitats, Fish, Lake shores, Habitats, Dredging.

Shore erosion is a major problem along many ocean beaches and the shoreline of the Great

Lakes. The Corps of Engineers replenishes and nourishes eroding beaches by pumping sand onto the beach. Beach replenishment creates a new habitat that is uninhabited by benthic animals, except for those that may have survived being pumped to the beach with the replenishment sediments or those that survived by vertical migration through deposited sediments. Timing of the replenishment operation may also be a critical factor in reestablishment of benthic animals. Adjustment of benthic animals to replenishment is generally expected since the animals are accustomed to natural disturbances and have demonstrated the ability to recover rapidly. Corals pose a special problem along replenished beaches in Florida. The mobility of fish and some invertebrates render them less vulnerable to the adverse effects of beach replenishment than the nonmotile benthic communities. Destruction of habitat rather than suspended sediment seems to be greater potential problem to fish. Moderate to complete recovery of motile animals will usually occur within less than a year unless a required habitat or food source is permanently lost. Sea turtles are one of the most vulnerable motile vertebrate animals to the effects of beach replenishment. The major physical impact of dredging borrow material is the mechanical disturbance of the substrate and the subsequent redistribution of suspended sediments and turbidity. Potentially, the most serious impacts of offshore dredging are the loss or damage to major commercial species of benthic shellfish, seagrass beds, and corals. Repopulation of a dredged area by benthic animals will depend on the magnitude of the disturbance, the new sediment interface, and the water quality in the borrow pit. (Baker-IVI)
W86-01844

7. RESOURCES DATA

7A. Network Design

LAKE ERIE NUTRIENT LOADS, 1970-1980,
Corps of Engineers, Buffalo, NY. Lake Erie Wastewater Management Study.
For primary bibliographic entry see Field 5G.
W86-01344

CORBICULA FLUMINEA (MOLLUSCA: PELECYPODA) AS A BIOLOGICAL INDICATOR OF HEAVY METALS IN THE KANAWHA RIVER, WV,
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
J. E. Joy, A. J. Pritchard, and D. Danford.
Proceedings of the West Virginia Academy of Science, Vol. 55, No. 2/3/4, p 113-117, 1983. 8 Ref. Virginia Environmental Endowment grant 81-101.

Descriptors: *Clams, *Bioindicators, *Heavy metals, *Kanawha River, *West Virginia, Cadmium, Iron, Metals, Indicators, Zinc, Copper, Manganese.

Two hundred large (16 to 24 mm) Corbicula fluminea individuals were monitored for 10 heavy metals at four different sites (50 clams at each site) on the Kanawha River over a nine week period. Analysis of the viscera revealed silver in the smallest concentrations (between 0.1 and 0.2 micro-g/g) of the metals at all four sites. Cadmium was also found in low concentrations (between 0.2 and 0.4 micro-g/g). Iron was found in the highest concentrations, in some cases surpassing 500 micro-g/g. Magnesium levels were also high, generally ranging between 100 and 200 micro-g/g at all sites. Concentrations of zinc were interesting because of their virtually unchanging levels (approximately 30 micro-g/g) at all four sites over the nine weeks. Copper concentrations were also very constant (between 7.0 and 9.0 micro-g/g) at all sites with the exception of weeks 7 and 9 at Marmet when copper levels reached 17.0 and 12.0 micro-g/g, respectively. While generally low, chromium levels were quite variable, ranging from 0.5 micro-g/g at London, to a high of 12.0 micro-g/g at Glen Ferris. Manganese levels were also quite variable, ranging from a low of 9.2 micro-g/g at Winfield to a high of 100 micro-g/g at London. (Author's abstract)
W86-01596

HETEROTROPHIC BACTERIA IN WATER DISTRIBUTION SYSTEMS. II. SAMPLING DESIGN FOR MONITORING,
Centre des Sciences de l'Environment, Metz (France).
For primary bibliographic entry see Field 5F.
W86-01915

7B. Data Acquisition

EVALUATION ON POLLUTION IN THE XIANG JIANG RIVER BY USING ZOOBENTHOS,
Academia Sinica, Lochiaschan (China). Inst. of Hydrobiology.
L. Baoyuan, W. Shida, and H. Deliang.
Acta Hydrobiologica Sinica, Vol. 8, No. 2, p 225-236, May, 1984. 3 Fig, 7 Tab, 11 Ref.

Descriptors: *Water pollution, *Bioindicators, *Zoobenthos, *Xiang Jiang River, China (Peoples Republic), Species diversity, Mayflies, Indicators, Water pollution effects.

Studies on zoobenthos in the Xiang Jiang River were carried out five times between July, 1980 and December, 1981. Artificial substrate was used for sampling in all stations in the river, especially the heavily polluted area between Zhuzhou and Xiangtan. Based on the data obtained from the survey, the Shannon diversity index was calculated and used for the biological evaluation of water quality of the river. The relationship between the number of zoobenthos and the chemical content was also calculated in some stations. Results show that the mayfly naiads are more sensitive to heavy metals and pesticides and may be used as monitors for water pollution in the river. The percentage of ephemeropterans and trichopterans as compared with that of the other aquatic insects used for water monitoring was also determined. In nearly all stations the diversity indices were more than 2.11, except the Xiawan station, where the index was only 0-0.73. (Author's abstract)
W86-01323

HABITAT REQUIREMENTS AND BIOINDICATOR VALUE OF THE MAIN COMMUNITIES OF AQUATIC VEGETATION IN NORTH-EAST POLAND,
Warsaw Univ. (Poland). Dept .of Phytogeography.
For primary bibliographic entry see Field 2H.
W86-01326

EFFECTS OF EFFLUENT OF MUNICIPAL WASTEWATER ON THE GROWTH OF PORPHYRA YEZOENSIS IN THE CASE OF STATIC CULTURE (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan).
For primary bibliographic entry see Field 5C.
W86-01363

SLEEVE AND CASING LYSIMETERS FOR SOIL PORE WATER SAMPLING,
Wisconsin Univ.-Madison. Dept. of Soil Science.
R. Morrison, and J. Szecsody.
Soil Science, Vol. 139, No. 5, p 446-451, May, 1985. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Lysimeters, *Pore water, *Water sampling, *Sleeve lysimeters, *Casing lysimeters, Particle size, Monitoring wells, Wells.

Two pore water samplers were designed for the purpose of incorporating a lysimeter into the casing of a monitoring well and to provide multiple sampling capabilities in a single retrievable section. A sleeve lysimeter was fabricated for use with a monitoring well and provided multiple sampling points to depths of about 15 m. The casing lysimeter provides multiple sampling points to depths in excess of 15 m by incorporating several lysimeters with threaded PVC well casing. minimum vertical distance between the porou tions of two lysimeters was calculated us linearized solution of the matric potentia steam functions for various soils at finite an nite depths. A vertical spacing not less th times the lysimeter radius (20 r sub 0) is app ate for most soils. The radius of sampling infl is maximized if the borehole diameter is slightly larger than the lysimeter, and a grained silica flour (grain size 0.032 mm) is for an optimum backfill around the porous s of the lysimeter. (Author's abstract)
W86-01422

DESIGN OF A SENSITIVE AND PRACT CLOSED-TOP INFILTROMETER,
Haryana Agricultural Univ., Hissar (India). of Soils.
For primary bibliographic entry see Fiel
W86-01423

IRRIGATION SCHEDULING USING CRO DICATORS,
Agricultural Research Service, Phoenix, Water Conservation Lab.
R. J. Reginato, and J. Howe.
Journal of Irrigation and Drainage Engine Vol. 111, No. 2, p 125-133, June, 1985. 5 F Ref.

Descriptors: *Irrigation scheduling, *Water *Plant physiology, Soil water, Cotton, C temperature, Petioles, Crop yield.

Plant stress utilizing crop temperature unde conditions may be quantified utilizing a crop stress index (CWSI). Petiole water conte canopy temperature of cotton were used as tors of stress in cotton. Air temperature w fined as the value obtained with an aspirate psychrometer at the time canopy temperatu measured each afternoon. Canopy tempe were taken daily about an hour past solar four looking east and four looking west, do rows. Solar radiation was measured with a sensor each minute and integrated into an basis, ultimately yielding daily totals. Petiole content was measured daily by weighing p and determining the weight difference afte oven dried for 24-hrs. Crop yield was ob from each plot using a standard cotton pic CWSI using remotely sensed canopy tempe was a better indicator of plant stress tha petiole water content. This point was most c when using these parameters as a potential t scheduling irrigations and for estimating lint yield prior to harvest. Petiole water conte not possess the sensitivity of a CWSI for as crop stress. PWC involves a labor intensi structive plant sampling procedure which data for a single plant part, whereas a C derived from a measurement that surveys plants. For a rapid assessment of crop st schedule irrigation and estimate yield, it appropriate to use the CWSI. (Collier-IVI)
W86-01433

THERMAL INFRARED DETECTION OF MARINE SPRINGS ASSOCIATED WITH PLYMOUTH LIMESTONE,
Plymouth Polytechnic (England). Dept. of ronmental Sciences.
For primary bibliographic entry see Field 2F
W86-01443

UPTAKE AND RELEASE OF SOME T METALS BY AQUATIC BRYOPHYTE ACIDIFIED WATERS IN SCOTLAND,
Freshwater Fisheries Lab., Pitlochry (Sco
L. A. Caines, A. W. Watt, and D. E. Wells.
Environmental Pollution (Series B), Vol. 10, p 1-18, 1985. 10 Fig, 3 Tab, 24 Ref.

Descriptors: *Bryophytes, *Bioconcen *Bioindicators, *Trace metals, *Aluminum, ity, *Scotland, *Loch Ard Forest, *Gallow dicators, Metals, Moss, Liverwort, Ind

ollution effects, Manganese, Zinc, Hydro-
oncentration, Acid rain.

tes can be considered as thin sheets of
ndifferentiated cells in more or less inti-
ntact with their physical and chemical
ings and therefor can reflect the chemical
their environment. Aquatic bryophytes
n analyzed for aluminum, manganese and
sess the feasibility of using these plants as
tors of metal loadings to acid streams and
Loch Ard Forest (30 km N of Glasgow)
Galloway area of southwest Scotland.
are was taken in sample preparation to
ll extraneous mineral particles from the
and moss samples. Bioconcentration oc-
all waters but increased hydrogen ion
tions in the water were associated with
metal concentrations in the bryophytes.
dependence between Al and H(+) con-
was demonstrated in the Loch Ard
eam water samples; the maximum con-
of Al in a stream with pH 6.62 was 25
compared with 400 micro-g/l in a stream
nnual mean pH of 4.43. The seasonal
n Al concentration which occured in the
stream had a maximum concentration of
-g/l in February, which declined rapidly
o-g/l in May (1980); this sharp decrease
with a prolonged dry spell with low
ich resulted in a rise in stream pH and a
duced leaching of Al from the catch-
ease of aluminum, manganese and zinc
ryophytes by hydrogen ions may make a
contribution to the loadings of these
id waters. While the pH remains above
netals such as Al and Mn are taken up
d by the bryophyte. At lower pH values
ir of metal ions may be released into
water. It is possible that a sharp drop in
release sufficient trace metals to exceed
sholds for fish and other organisms.
I)

RM STREAMFLOW OBSERVA-
RELATION TO BASIN DEVELOP-

eronautics and Space Administration,
MD. Hydrological Sciences Branch.
bibliographic entry see Field 4C.

F THE HYDROGEOPHYSICAL
ES OF FISSURED AQUIFERS
OUBLE POROSITY MODEL,
l. of Science and Technology, London
iv. of Engineering Geology.
bibliographic entry see Field 2F.

AERIAL PHOTOGRAPHY AND
ROCESSING TO MEASURE DYE
N FROM A LONG SEA OUTFALL,
y Coll. of Science, Shrivenham (Eng-
of Civil Engineering.
son, and P. J. Curran.
of the Institution of Civil Engineers,
27-348, June, 1985. 7 Fig, 9 Tab, 35

*Aerial photography, *Image proc-
dispersion, *Outfalls, Remote sensing,
ye releases, Tracers, Wastewater dis-

graphy and image processing to meas-
ersion was carried out as part of an
ly to assess the performance of a 3500
utfall discharging off the south coast
A slug of Rhodamine WT dye was
he sewage at the pumping station on
e tracer emerging from the outfall's
n and its subsequent dispersion in the
sured by boat survey and by aerial
The black and white aerial photo-
digitized and manipulated using a
processor so that the red reflectance
uld be correlated with the concentra-
easured in the sea. A high level of correlation between red reflectance and the dye concentration was achieved. This correlation was then used as the basis for predictive mapping of dye concentration from other black and white aerial photographs, and detailed contours of dye concentration for a number of time frames were prepared. A high level of accuracy was obtained when the dye concentrations determined from the processed black and white aerial photographs were compared with direct measurements. (Author's abstract)
W86-01518

REPLACEMENT OF THE TELEMETRY SYSTEM OF THE SUNDERLAND AND SOUTH SHIELDS WATER COMPANY,
R. T. Heslop.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 3, p 231-237, June, 1985. 2 Fig.

Descriptors: *Telemetry, *Water conveyance, Water management, Water distribution, Planning, Automation, Monitoring, Water quality, Water treatment.

A telemetry system is described as it was applied to the Sunderland and South Shields Water Company which currently supplies 140 ml/d of water to a population of 554,000 in the 342 sq km area covering the coastal strip south of the river Tyne to just north of Hartlepool, England. Originally the 23 principal outstations were linked by rented land line omnibus circuits to the Company. The 25 minor outstations were linked to the nearest principal outstation by direct land line conveying data from the satellite in analogue form. Early proposals for the replacement of the master station involved the use of purpose-built computers designed by the telemetry manufacturer. The original intention was to retain the original outstations, but the cost of providing a special director unit required to enable original outstations to communicate via the omnibus circuits with the new master station was very high. Thus it was decided to replace the original hard wired outstations with CMOS equipment. The use of the telemetry system has long since progressed from the simple activity of monitoring. Presently the Company uses its central control functions and infomation in matters of waste prevention and efficient source utilization. Projected applications of the system are in the following areas: dynamic network analysis of the distribution network; waste location, assessment, and prevention; trunk main management; monitoring of flow meters, efficiency service intervals and optimized locations; pressure zoning and control; water quality distribution and zoning, including effects of system alterations on the processes of sensitive industrial consumers; complaints monitoring and management; control of use of fire hydrants; system chlorination control; discolored water preventive measures; control of animal infestation in mains; correlation of rainfall and hydrological data; pollution of souces; monitoring of groundwater well levels and correlation with source output; and groundwater source interaction and correlation. (Baker-IVI)
W86-01521

ASSESSING HABITATS USED BY WARM-WATER STREAM FISHES,
Illinois Natural History Survey, Champaign.
For primary bibliographic entry see Field 2H.
W86-01599

METHOD FOR LOCATING SEDIMENT ANOMALIES IN LAKEBEDS THAT CAN BE CAUSED BY GROUNDWATER FLOW,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 2H.
W86-01667

STRIPPING ANALYSIS AND CHROMATOGRAPHIC SNIFFING FOR THE SOURCE IDENTIFICATION OF ODOROUS COMPOUNDS IN DRINKING WATER,
Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society.
R. Savenhed, H. Boren, and A. Grimvall.
Journal of Chromatography, Vol. 328, p 219-231, June, 1985. 4 Fig, 5 Tab, 27 Ref.

Descriptors: *Pollutant identification, *Organoleptic properties, *Stripping analysis, *Chromatographic sniffing, Odors, Water pollution sources, Water analysis.

Chemical and sensory methods have been combined into an improved technique for the source identification of odorous compounds in drinking water. A simple device for gas chromatographic sniffing, in which the capillary column is lead to the odor observer via heated copper tubing, has been developed. This system is highly sensitive and highly accurate for the determination of retention times. A stripping technique that permits high stripping temperatures without technical problems has also been developed, and it has been shown to increase significantly the number of odorous compounds detected by column sniffing. The design of the stripping system gives a very low blank level that results in almost no compounds detected on column sniffing of extracts from odor-free water. Odor profiles from a river basin with discharges from agriculture, industry and municipalities are presented. Special attention has been given to the effects of pulp mill discharge, and it is shown that they are mainly of local importance with regard to odorous compounds. (Author's abstract)
W86-01696

OPERATIONAL RANGES FOR SUCTION LYSIMETERS,
Kaman Tempo, Santa Barbara, CA.
For primary bibliographic entry see Field 2G.
W86-01697

FACTORS REQUIRING RESOLUTION IN INSTALLING VADOSE ZONE MONITORING SYSTEMS,
Woodward-Clyde Consultants, Santa Ana, CA.
G. A. Robbins, and M. M. Gemmell.
Ground Water Monitoring Review, Vol. 5, No. 3, p 75-80, 1985. 3 Fig, 1 Tab, 5 Ref.

Descriptors: *Vadose water, *Monitoring, *Pollution detection, *Aeration zone, Path of pollutants, Fate of pollutants, Waste disposal, Wells, Lysimeters, Vapor probes, Tensiometers, Conductivity.

Increasingly, regulations by federal, state and local agencies are being developed that require the installation of vadose zone monitoring systems for hazardous chemical facilities in addition to, or in lieu of, conventional groundwater monitoring wells. Compared to a ground water monitoring approach, vadose zone monitoring systems may permit earlier detection of chemical leakage and less costly cleanup of contamination. The effective use of vadose zone monitoring systems in detecting contamination dependes on many factors. Without proper consideration of these factors, a vadose zone monitoring system may not give as high a level of reliability as a groundwater monitoring system. Major factors to consider in installing a vadose zone monitoring system are: type of instrument to use, number of instruments, depths and location of instruments, and frequency of monitoring. Means to evaluate these factors in a comprehensive fashion have been lacking. Based on recent experience in installing and operating vadose zone monitoring systems, criteria and methods useful in resolving the preceeding factors have been developed. Types of instruments can be classified as either direct (lysimeter, vapor probe) or indirect (tensiometer, conductivity probe). A combination of the two is needed for reliability. The depth, location and number of instruments depend on the geometry of the facility, the number and size of likely contaminant leakage points in engineered barriers, properties of the material being monitored, the effective radius of monitoring for each instrument, vadose zone properties, and types of remedial actions that are available. The frequency of monitoring largely depends on the rate of movement of the contaminant. Evaluating the preceding

factors requires some level of modeling and preliminary field testing. (Author's abstract)
W86-01701

DETERMINATION OF INDIUM IN MINERALS, RIVER SEDIMENTS AND COAL FLY ASH BY ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY WITH PALLADIUM AS A MATRIX MODIFIER,
Academia Sinica, Beijing (China). Inst. of Environmental Chemistry.
X.-Q. Shan, Z.-M. Ni, and Z.-N. Yuan.
Analytica Chimica Acta, Vol. 171, p 269-277, 1985. 5 Fig, 3 Tab, 16 Ref.

Descriptors: *Indium, *Chemical analysis, *Electrothermal Atomic Absorption Spectrometry, *Atomic absorption, *Trace metals, *Sediments, *Fly ash, Palladium, Metals, Spectrometry.

Due to the low levels of indium found in minerals and rocks, analyses have depended on neutron activation and spark-source mass spectrometry. A method is described for the determination of indium (10-40 micro-g/g) in lead-zinc ores and magnetic pyrites. Graphite furnace atomic absorption spectrometry is used with palladium as a matrix modifier. Indium (down to 0.085 micro-g/g) in river sediments and coal fly ash can be determined after pre-extraction with ammonium iodide into 4-methyl-2-pentanone. The low sensitivity for indium was assumed to be due to the vaporization of molecular species of indium during the pre-atomization stages, and efforts were made to find suitable matrix modifiers which might prevent such a vaporization loss. Of several metal salts tested for this purpose, palladium was shown to be the best modifier, although all metals tested at least doubled the sensitivity. The indium absorbance in the absence of matrix modifier obtained after ashing at 600 C was used as a baseline against which the enhancement properties were measured. In the presence of palladium, the maximum tolerable ashing temperatures for indium in aqueous solution or organic extract can be raised to 1200 C or 1000 C, respectively. The sensitivity is improved by a factor of three compared to that obtained for pure aqueous indium solutions. It is assumed that the addition of palladium stabilizes indium by forming more thermostable compounds or alloys and decreases the formation of volatile species such as InO, thus enhancing the atomic absorbance. (Collier-IVI)
W86-01718

DISCRIMINATION OF SOIL PHYSICAL PARAMETERS, THERMAL INERTIA, AND SOIL MOISTURE FROM DIURNAL SURFACE TEMPERATURE FLUCTUATIONS,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
For primary bibliographic entry see Field 2G.
W86-01772

APPROXIMATE ANALYSIS OF THE BOREHOLE PERMEAMETER IN UNSATURATED SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
For primary bibliographic entry see Field 2G.
W86-01774

INSTRUMENT FOR MEASURING THE AVERAGE STOMATAL CONDUCTANCE OF CONIFER SEEDLINGS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
For primary bibliographic entry see Field 2I.
W86-01782

SET OF REMOTE-SENSING APPARATUS FOR QUICK METHODS OF HYDROLOGIC OBSERVATIONS ON INLAND WATER BODIES,
Limnologeskii Inst., Moscow (USSR).
G. V. Druzhinin, V. M. Ivanov, O. E. Korotkevich, A. M. Kryuchkov, and V. B. Rumyantsev.
Water Resources, Vol. 11, No. 3, p 273-280, May-June, 1984. 5 Fig, 15 Ref. Translated from Vodnye Resursy, No. 3, p 147-154, May-June, 1984.

Descriptors: *Water quality, *Monitoring, *Remote sensing, Water quality control, Evaluation, Measuring instruments, Computers.

One of the most important problems of monitoring inland water bodies is to obtain a prompt determination of the water quality. Quick methods of observation are needed by means of which the actual state of water masses, elements of their dynamics, presence of wastewaters in water bodies, routes of their spreading, and other parameters can be determined. A set of remote-sensing apparatus meeting these indicated requirements has been developed and is undergoing testing. A description is given of the various parts of the system including the resistance thermometer, conductometer, oximeter, water transparency meter, and the meter used to determine the depth of submergence of the group of sensors. Further improvements are expected to be accomplished by increasing the number of measured physical and chemical characteristics through the addition to the set of new sensors for a more reliable identification of water masses in the basin and through the conversion of the recording of the measured parameters to a form convenient for input into a computer and also the possibility of transmitting the information over a radio channel. The solution of these problems will considerably increase the promptness of monitoring water bodies. (Baker-IVI)
W86-01828

RADIO-TELEMETRY AS AN AID TO ENVIRONMENTAL CONTAMINANT EVALUATION OF MOBILE WILDLIFE SPECIES,
Battelle Pacific Northwest Labs., Richland, WA.
L. E. Eberhardt, and L. L. Cadwell.
Environmental Monitoring and Assessment, Vol. 5, No. 3, p 283-289, September, 1985. 2 Fig, 17 Ref. DOE contract DE-AC06-76RLO 1830.

Descriptors: *Telemetry, *Wildlife, *Radioactive wastes, Remote sensing, Monitoring, Radioactive waste disposal, Waste ponds, Ducks, Deer, Hanford, Washington.

Programs monitoring wildlife species for environmental contaminants from localized sources can maximize the amount of information obtained from an individual animal by using radio-telemetry to ascertain residence history. The use of radio-telemetry techniques on two mobile wildlife species, mule deer (Odocoileus hemionus) and mallard ducks (Anas platyrhynchos), to document their use of and movement from low-level radionuclide contaminated waste ponds are described. The study was conducted on or near two man-made waste management ponds located approximately in the center of the Hanford Site in southcentral Washington. Both ponds, which now support dense stands of aquatic and riparian species, receive effluent water from chemical and waste processing plants associated with the nuclear facilities. Radiotelemetry techniques provided the opportunity to ascertain the residence history of highly mobile wild animals and to select those few individuals for sampling that have a known residence history within the area of interest. Radio-telemetry techniques can provide data on the extent, direction or location, and seasonality of movement by mobile wildlife species that may aid in interpreting potential impact to consumers (man) from ingestion pathways. (Moore-IVI)
W86-01886

COMPARISON OF THREE FIELD METHODS FOR MEASURING SATURATED HYDRAULIC CONDUCTIVITY,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
For primary bibliographic entry see Field 2G.
W86-01909

7C. Evaluation, Processing and Publication

COMPUTER AIDED MAPPING PR AIDS SEVERN TRENT,
For primary bibliographic entry see Field 6.
W86-01631

CALCULATING WITH MICROCOMPUT
For primary bibliographic entry see Field 6.
W86-01632

GROUND-WATER RESOURCES OF TO COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Wa sources Div.
For primary bibliographic entry see Field 2.
W86-01917

8. ENGINEERING WORKS

8A. Structures

NOTE ON THE SHAPES OF FLEXIBLE
University of Manchester Inst. of Scien Technology (England).
R. Watson.
Journal of Hydraulic Research, Vol. 23, N 179-194, 1985. 19 Fig, 1 Tab, 11 Ref.

Descriptors: *Dam design, *Flexible dam construction, Inflatable dams, Temporary tures.

Flexible dams are in use as both tempor permanent structures in a number of countr types considered here are usually construc textile fabric heavily impregnated and cove a synthetic rubber. The inflatable variety common and consists of a sheet of fabric a to the channel bed at two edges and inflat either air or water. Tension in water inflat is usually rather higher but, in many cases, easier to operate. Some properties of co dams are examined. These include the pro tension per unit width and fabric length - th being roughly proportional to the cost of th rial. Also shown are the fabric lengths, the enclosed, the base length and the total pe The change of shape of a dam during inflati water or with air is discussed. The info provided should help to clarify the mech inflatable dams and allow suitable dam shap designed to fit any required static conditi their behavior during inflation predicted. IVI)
W86-01394

ROCKBURST DRAMA IN NORTHERN
Bhakra Dam (India).
R. K. Malhotra.
Tunnels and Tunnelling, Vol. 17, No. 4, April, 1985. 4 Fig, 1 Tab.

Descriptors: *Tunnels, *Rockbursts, *C tion, *India, *Beas-Satluj Link Project, Mass wasting, Rock mechanics, Geologic tures.

Problems encountered during the excava two pressure tunnels, involving 25.55 km of ling, in the gigantic inter-river basin transfe Satluj Link Project in India are reviewe Project involved tunnelling through weak s the geologically young Himalayan ranges lems were manifold due to encountering in tent strata with faults, shear zones, water-crushed rock and pressure-exerting strata ondly, as it was the first time that tunnels length and diameter were designed and ex totally by Indian skill, there were problems by inexperience. In actual excavation, p quartzites and granites in relatively dry con proved to be good tunneling media. In the reach, massive to moderately jointed granit

l 55% while the percentage of highly joint-locky granites came to about 30% with the ed shear zones and highly kaolinized pock-ing up the remaining 15%. While tunneling n weak geological formations, there were us incidents associated with rock bursts, gence and shearing of steel supports leading rtual collapse of the heading. (Baker-IVI)
462

TERING FOR THE WELL-BEING OF ELLING,
s.
and Tunnelling, Vol. 17, No. 5, p 46-48, 85. 5 Fig.

tors: *Tunnel construction, *Tunnels, dwater management, *Wellpoints, Con-, Dewatering.

water control by wellpointing is a standard in the armory of tunnelling engineers. nting is frequently employed in combina-h other methods, whether simultaneously ferent stages of the same project. Where unt of water is substantial, pumping from rounding the excavation site is desirable as arely enough room in the tunnel to install ng equipment of sufficient capacity. When onjunction with other methods of ground nent, this can reduce materials consump-ny factors considerably restrict the appli-dewatering by wellpoints. Pump capac-gical structure of the ground itself, per-, and type of strata each affect the out-ellpointing is mainly used with shallow ns whether cut and cover or true tunnel-en water bearing strata is expected during ng it is usual to work under compressed tering by wells can frequently speed the n of a tunnelling project. Specific exam-e use of these dewatering techniques are nsidered. (Baker-IVI)
3

C ANALYSIS OF SHORT-LENGTH DAMS,
pkins Univ., Baltimore, MD. Dept. of neering.
hed, and W. D. Iwan.
Engineering Mechanics, Vol. 111, No. 1083, August, 1985. 7 Fig, 1 Tab, 19 Ref.

s: *Gravity dams, *Dam stability, *Dy-ams, Mathematical equations, Reservoir ration, Compressibility, Ground motion.

ary investigation of the dynamic behav-t-length gravity dam reservoir systems is A simplified and economical procedure namic analysis of such structures is de-ased on the Rayleigh-Ritz method and cture concept. The dam is modeled as a of uniform thickness, whose out of rmation is governed by a pure shear e water in the reservoir is treated as a and its compressibility and the flexibil-reservoir floor and sides are taken into on. Neglecting water compressibility, ion analyses are performed on dams fferent length-to-height ratios, with totally full reservoir conditions. As he natural frequencies are reduced in o the presence of water, and antisym-les of vibration are developed. Com-he two-dimensional case of infinitely the natural frequency of a dam in-value as its length to height ratio de-forced vibration analysis is carried out uency domain, including water com-and flexibility of reservoir boundaries. acement and acceleration responses of various length to height ratios to all onents of harmonic ground motion are he change in the length to height ratio affects these frequency domain re-ecrease in the value of B/D shifts the equencies to the right, and alters the plitudes. Also, the transverse compo-nd motion contributes a small amount esponse, as compared to the longitudi-nal component contribution, while the vertical component contributes a significant amount. (Baker-IVI)
W86-01529

COMPACTION CHARACTERISTICS OF RIVER TERRACE GRAVEL,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W86-01532

WAYS TO IMPROVE THE TECHNOLOGY OF CONSTRUCTING CONCRETE HYDRAULIC STRUCTURES,
For primary bibliographic entry see Field 8F.
W86-01622

STABILITY OF THE ZHITOMIR CELLULAR BUTTRESS DAM,
V. I. Zeryukov, and S. I. Karlin.
Hydrotechnical Construction, Vol. 18, No. 11, p 533-537, November, 1984. 4 Fig, 1 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 15-18, November, 1984.

Descriptors: *Abutments, *Butress dams, *Dam stability, Overflow dams, Cellular construction, Reinforced concrete, Dam construction, Monitoring.

The Zhitomir overflow dam, constructed in 1962-1965 on the Teterev River on the western outskirts of Zhitomir city, has been in operation for more than 15 years. The hydraulic structures include a precast reinforced-concrete overflow cellular buttress dam with a standard-shaped head, abutments, and a 1-m-diameter dewatering pipe outlet enclosed in the left-bank abutment. Ten cracks were found in the abutments, of which 8 were in the right-bank abutment and 2 in the left-bank abutment. Visual inspections of the Zhitomir overflow dam in 1980 showed that during its operation the negligible cracks that appeared have not affected the strength of the structure. As a rule, all cracks were due to temperature effects. In order to improve monitoring of the condition of hydraulic structures, it is recommended that they be equipped with measuring instruments such as height markers and piezometers. (Keenan-IVI)
W86-01626

DESIGN CRITERIA FOR RESERVOIR BOTTOM OUTLETS,
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserbau.
H. Blind.
International Water Power and Dam Construction, Vol. 37, No. 7, p 30-32, July, 1985. 6 Fig.

Descriptors: *Design criteria, *Reservoirs, *Outlets, Drawdown, Dam construction, Reservoir operation, Dam design, Flood control.

Based on experience, the provision of a bottom outlet in a dam is generally necessary. The bottom outlet, in addition to serving the purpose of normal reservoir emptying, should be designed to provide adequate discharge capacity for operational conditions such as emptying the reservoir for emergency repair work. According to the requirements and limitations of the scheme, the capacity of a bottom outlet can vary considerably. If enough discharge structures are available, the capacity of the bottom outlet can be kept relatively small. An essential factor to consider is the desired time for emptying the dead reservoir storage. Should large discharge structures be available, it will be necessary to install a very efficient bottom outlet for operational and safety reasons. The possibility of drawing down the water level rapidly in case of damage to the dam or within the storage area can be very important. In addition it might be necessary, for repair work, to have an additional outlet available during drawdown. In recent years these aspects have been taken into account at many dam projects throughout the world. According to operational characteristics, the size of the dam and its storage volume as well as inflow and outflow quantities, bottom outlets with capacities of up to 500 cu m/second have been constructed. Designers are advised to examine and determine carefully and conscientiously the arrangement and capacity of a bottom outlet. (Baker-IVI)
W86-01690

WATERPROOF ELEMENT FOR EMBANKMENT DAMS,
A. D. M. Penman.
International Water Power and Dam Construction, Vol. 37, No. 7, p 33-36, 41-48 and 112, July, 1985. 17 Fig, 2 Tab, 42 Ref.

Descriptors: *Embankments, *Earth dams, Clay, Concrete, Rolled concrete, Construction, Walls, Membranes, Cutoffs, Dam cores.

The purpose of the waterproof element for embankment dams is to limit the flow of water so that material is not carried away, and so that the downstream drains can cope with the flow to ensure that porewater pressures do not exceed design assumptions. This overview looks at developments in techniques over the years for the construction of the waterproof element for embankment dams. Homogeneous dams, central clay cores (puddled clay cores and rolled clay cores), central core walls (concrete, asphalt, and plastic concrete, upstream membranes (concrete, asphalt, thin sheets), below ground cutoffs (grout curtain, diaphragm walls), and the connection between a dam and an underground cutoff are each discussed. (Baker-IVI)
W86-01691

CONSTRUCTION OF THE RIDRACOLI DAM,
Consorzio Acque per le Province di Forli e Ravenna (Italy).
P. P. Marini, and F. Bavestrello.
International Water Power and Dam Construction, Vol. 37, No. 7, p 52-56, July, 1985. 7 Fig, 2 Tab.

Descriptors: *Ridracoli Dam, *Italy, Dam construction, Rocks, Dam foundations, Sandstone, Rock mechanics, Gravity dams, Arch dams.

The Ridracoli Dam (Italy) is of the concrete gravity-arch type and was completed in the spring of 1982. The dam has a rock foundation of alternating layers of marl and sandstone. The structural and mechanical characteristics of this rock caused problems during excavation as a danger was foreseen of rock layers slipping along the bedding planes. Detailed studies were therefore required, including lab tests, to ensure that stability would not be jeopardized by excavations for the dam. Work on the dam began in 1975 and took about seven years to complete, three of which were spent solely on extensive base excavations. The pouring of the concrete began in the summer of 1978 and was completed in the spring of 1982. The operation to stabilize the excavations and the work of sealing and consolidating the foundation rock were carried out under a sub-contract. (Baker-IVI)
W86-01692

SADD-EL-KAFARA: THE WORLD'S OLDEST LARGE DAM,
Technische Univ. Braunschweig (Germany, F.R.). Leichtweiss-Inst. fuer Wasserbau und Grundbau.
G. Garbrecht.
International Water Power and Dam Construction, Vol. 37, No. 7, p 71-76, July, 1985. 3 Fig, 8 Ref.

Descriptors: *Dam construction, *Sadd-el-Kafara, *Egypt, *History, *Flood control, Design criteria, Flood damage.

The Sadd-el-Kafara dam was investigated in detail for the first time in 1982. The dam was constructed in the era of the Old Egyptian Empire, about 1600 BC, and represents the first attempt at storing water on a large scale. The purpose of the dam was apparently to protect installations in the lower wadi and in the Nile valley from the frequent and sudden floods following heavy rainfalls. The dam, by modern standards, is stable and would have withstood the floods reasonably to be expected if it had been completed. A flood during the construc-

tion period appears to have led to destruction, followed by a catastrophic flood wave. Construction was abandoned. The design was basically correct and the dam was adequately protected from damage caused by water bypassing the dam on the left bank or overtopping. Thus it was a tragedy that an unexpected flood created such a disaster. Even after 4500 years and on the basis of all present day knowledge and experience, the greatest respect must be paid to the Egyptian engineers for having the courage to construct the dam with the limited technological means and scarce scientific knowledge at their disposal. (Baker-IVI)
W86-01693

POWER CONDUITS FOR HIGH-HEAD PLANTS; PART TWO,
Innsbruck Univ. (Austria). Inst. fuer Konstruktiven Wasserbau und Tunnelbau.
G. Seeber.
International Water Power and Dam Construction, Vol. 37, No. 7, p 95-98, July, 1985. 5 Fig, 15 Ref.

Descriptors: *Dam construction, *Power head, *Design criteria, Construction, Dams, Conduits, Pressure tunnels, Shafts, Tunnels, Linings.

The criteria which govern the selection of the technique used to line a power conduit are assessed. The increasing number of high-head storage and pumped-storage schemes built during the past quarter of a century has called for a more critical assessment of the relative benefits of the various methods of lining pressure tunnels and shafts. Applications are given for the following methods: concrete lining plus seal; concrete lining plus thin steel seal; and thickwalled steel linings. In the case of peak load power stations with marked fluctuations in dynamic pressure, special emphasis must be place on engineering and installing the lining with an eye to achieving optimum fatigue strength. In particular, one must take care to avoid notches, sudden changes in thickness, obstacles to expansion, and compound stress. (Baker-IVI)
W86-01695

8B. Hydraulics

FLOW CHARACTERISTICS OF THE HYDRAULIC JUMP IN A STILLING BASIN WITH AN ABRUPT BOTTOM RISE,
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Civil.
W. H. Hager, and R. Sinniger.
Journal of Hydraulic Research, Vol. 23, No. 2, p 101-113, 1985. 11 Fig, 17 Ref.

Descriptors: *Hydraulic jumps, *Flow characteristics, *Stilling basins, Hydraulic properties, Fluid mechanics, Jets.

The flow characteristics in prismatic stilling basins with an abrupt rise of the channel bottom are analyzed. Proper accounting for the pressure distribution at the step leads to an expression for the conjugate flow depths in terms of the in flow Froude-number and the relative step height. It is found that the pressure distribution just in front of the step is not hydrostatic but must be augmented by the dynamical pressure head. For a given energy head and Froude-number at the upstream zone of the stilling basin, the dissipated energy is independent of the step height and corresponds to the value of a hydraulic jump on a horizontal bottom. For a given inflow Froude-number, transition between hydraulic jump and jet formation over the step depends on the relative step height. For vertical steps sweeping out and refilling of the stilling basin occurs at identical downstream conditions, whereas downstream flow depth must be higher for refilling when the step is positively inclined. The length of the roller and the jump are slightly longer in stilling basins with positive steps than for ordinary hydraulic jumps on horizontal bottoms. The present study allows a simple and rapid determination of all pertinent design quantitites for stilling basins consisting of an abrupt bottom rise. (Baker-IVI)
W86-01391

PREDICTION OF CHARACTERISTICS FOR VERTICAL ROUND BUOYANT JETS IN STABLY LINEAR STRATIFIED ENVIRONMENT,
Wuhan Inst. of Hydraulic and Electric Power Engineering (China).
W. Li, and C. J. Chen.
Journal of Hydraulic Research, Vol. 23, No. 2, p 115-129, 1985. 9 Fig, 15 Ref.

Descriptors: *Turbulent flow, *Buoyance, *Stratification, *Jets, Model studies, Hydraulic models, Water pollution, Turbulence, Heat flux, Shear stress, Kinetic energy.

The vertical turbulent buoyant jet discharging into a linear stratified environment is one of the most important and basic flow patterns related to environmental pollution. A turbulent model is used to study the behavior of round buoyant jets before the point of neutral buoyancy in stably linear stratified environments. The calculation of the center line velocity, density, turbulent kinetic energy, half-width of buoyancy jets and the profiles of turbulent kinetic energy, turbulent shear stress and turbulent heat flux are made for exit densimetric Froude numbers of 1.0 and 450.0 and strengths of stratification S = 0.0-0.11. A unified scaling law in non-uniform environments is derived for normalization of these results. The correlation of the predicted results shows that the established zone of buoyant jets in the stably linear stratified environment may be similarly divided into three regions for the uniform environment namely non-buoyant region, intermediate region, and plume region. The variation of centerline velocity, density and turbulent kinetic energy along the axial line for both uniform and linearly stratified environments is shown to fall into a single curve under the scaling law derived. The predicted results are compared with the experimental data with fair agreement. The spread of velocity half-width along the axial line for different strengths of stratification in a given exit densimetric Froude number converges to a single curve under the unified scaling law. Unlike the spread of velocity half-width the spread of temperature half-width first spreads and then converges near the established zone for the case of small ambient temperature gradients. For large ambient temperature gradients the spread tends to be convergent. The dimensionless mean velocity profile in the zone of established flow for different exit densimetric Froude numbers and strengths of stratification may be approximated by a Gaussian profile, and the dimensionless mean temperature profile can be expressed in two segments by two Gaussian profiles. The turbulent field does not reach the state of self-similarity at the location closed to the point of neutral buoyance. The predicted results of dimensionless turbulent transport properties are given at two locations for different exit densimetric Froude number. At each location the predicted results are shown to converge into a single curve for different ambient strengths of stratification. (Baker-IVI)
W86-01392

PLANE TURBULENT BUOYANT SURFACE JETS AND JUMPS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and S. Subramanyan.
Journal of Hydraulic Research, Vol. 23, No. 2, p 131-146, 1985. 7 Fig, 1 Tab, 17 Ref.

Descriptors: *Turbulence, *Jets, *Hydraulic jumps, *Fluid mechanics, Richardson numbers, Froude numbers, Buoyance, Surface jets, Entrainment.

Based on an experimental study of plane turbulent buoyant surface jets, the distinction between surface jets and surface jumps has been sharpened. For the surface jet, the growth of the thickness of surface jet in terms of the jet thickness at the outfall with the dimenionless longitudinal distance for a wide range of source Richardson numbers has been evaluated. The structure of the mean velocity in the surface jet has also been studied for a range of Richardson numbers. For surface jumps with supercritical densimetric Froude numbers as large as about 9 there is hardly any entrainment on its lower side. The dimensionless surface pro
the surface jump is the same as that of the
familiar open channel hydraulic jump. The
velocity field in the surface jump has also
studied. A comprehensive diagram has been
oped to predict whether a surface jet, or
jump or drowned jump will occur for given
ardson numbers and the downstream de
stratified flow in terms of the source thic
(Baker-IVI)
W86-01393

IMPACT OF RIVER CHANNELIZATIO CHANNELIZATION: SOME ENGINEE ASPECTS,
North West Water Authority, Warrington land). Rivers Div.
For primary bibliographic entry see Field 4A
W86-01402

IMPACT OF RIVER CHANNELIZATIO DOWNSTREAM MORPHOLOGICAL C QUENCES OF RIVER CHANNELIZATIO ENGLAND AND WALES,
Miljoestyrelsen, Silkeborg (Denmark). Fres Lab.
For primary bibliographic entry see Field 4A
W86-01403

NUMERICAL ANALYSIS OF KIELDER SPILLWAY,
University of Strathclyde, Glasgow (Sco Dept. of Civil Engineering.
J. Ellis.
Journal of the Institution of Water Engine Scientists, Vol. 39, No. 3, p 254-270, June, 1 Fig, 6 Ref.

Descriptors: *Spillways, *Planning, *Kielde *England, Dam design, Mathematical Management, Decision making, Design Model studies, Computers.

Two different numerical models are de which enable the engineer to assess the ef ness of alternative spillway arrangement quickly and economically. The first o models discussed is used to predict the wa face profiles of the spatially varying flow the collector channel of a side-discharge w both free and part submerged weir flow tions. The second model computes the supe tion of water level on the supercritical flow for a steep channel which is curved in pla models are used to analyze performance Kielder reservoir spillway and comparis made with observations undertaken on a p model of this spillway. Comparisons betwe puted water surface profiles and physical observations show good agreement. These indicate that numerical models may be us some confidence in preliminary design ways. Primary advantages of the numerical are its flexibility of application and relative my of operation. The numerical and p models are seen as complementary in the Numerical models may best be employed mize the main dimensions and alignment spillway. Having established the final co tion of the channel the physical model may to test the numerical model predicts are re design. (Baker-IVI)
W86-01523

EXPERIMENTAL MEASUREMENTS O TIPLE-JET INDUCED FLOW,
Hong Kong Univ. Dept. of Civil Engi
J. H. W. Lee, and C. W. Li.
Journal of Engineering Mechanics, Vol. 1 8, p 1087-1092, August, 1985. 4 Fig, 1 Tab

Descriptors: *Flow mechanics, *Jets, Turb Mathematical equations, Water flow, water, Water currents.

Basic experimental data on the flow gener N closely spaced non-buoyant turbulent oriented in the positive x direction into a

ıg current are reported. The submerged harge close to the bottom of a large receiv-er of uniform undisturbed depth, H. The cal predictions of the flow induced by a mentum source in a coflowing shallow urrent are satisfactorily corroborated by carefully designed laboratory experiments. chanics of such line jet groups in an in-rossflow is currently under investigation. VI)
30

LATION OF WAVE DIFFRACTION ON TOIRS OF HYDROELECTRIC AND AR POWER STATIONS,
gryadskaya.
chnical Construction, Vol. 18, No. 11, p November, 1984. 3 Fig, 10 Ref. Translat-Gidrotekhnicheskoe Stroitel'stvo, No. 11, November, 1984.

ors: *Breakwaters, *Wave diffraction, irs, Hydroelectric powerplants, Nuclear nts, Waves, Mathematical equations.

fraction by moles is an essential factor ermining the wave regime on protected as. In reservoirs of nuclear and hydro-ower stations, the role of moles is per-guide banks. The conventional method ts') of calculating wave diffraction on as protected by single or convergent eakwaters) is not applicable to cases of by offset or overlapping moles when tion of the width of the inlet is b < or = ondary deformation occurs. The method ficult to use when a successive (repeated) nt of the sites of protective structures is ed. A new method of calculating wave is presented which is free as far as f these shortcomings. Results from the od are compared with experimentally data. The proposed method can be used ing important practical problems, such mination of the wave regime on water a variable depth and with consideration ectral structure of the field of initial eenan-IVI)

OW MODELS CAN HELP SOLVE VITATION PROBLEMS,
l. 129, No. 7, p 49-50, July, 1985. 3 Fig.

: *Cavitation, *Pumps, *Mathematical Synergetic geometry, Model studies, puters,.

n pump cavitation can involve the fre-scribed classical forms on impeller or ess well known localized phenomena. techniques of analysis which can permit n of flow models that are simultaneous-, interactive and predictive concerns a bscure branch of mathematics, called geometry. A computer model of a a cavitation problem was created. The water in the space from the low pres-to the low pressure header was divided nient units called DROs. Each DRO number and all were observed from a the system, so that they appeared to be n accordance with the laws of syner-etry, the DROs formed into certain the pressure, temperature, or velocity eir volume changed, and consequently changed. The computer then identified rahelical patterns, in which tetrahedra n corkscrew chains by the sharing of a adjacent pair of tetrahedra. The com-dentified all patterns upstream of the until it had identified octal flow for a wo pipe diameters. The problem then and steps for a solution were under-nicircular vane was installed two pipe-pstream of the inlet; with the vane e cavitation and vibration ceased.

VORTEX TOWER FOR THE EL CAJON SPILLWAY INTAKE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
D. Schulthess.
International Water Power and Dam Construction, Vol. 37, No. 7, p 27-30, July, 1985. 8 Fig, 4 Ref.

Descriptors: *Hydraulics, *Vortex towers, *Intakes, *El Cajon, *Honduras, Spillways, Fluid mechanics, Flow, Model studies.

There is a risk that the gates around the intake zone at the El Cajon Dam, Honduras, could be damaged by the high velocity vortices. With partial gate openings, it is quite likely that logs that have been sucked in by a vortex will cause further damage by colliding with the gates. Further, air bubbles can expand under the gate lips and create instabilities in the uniform flow causing pressure fluctuations with large peaks. Some devices for the prevention of vortex formation have been described earlier. In a way, the vortex tower functions in a similar manner to an injector, and can be used to prevent vortex formation in a large secondary flow region. Tests have been performed with such a vortex tower, and these indicated that vortex formation is able to be controlled for a spillway intake of 1800 cu m/sec capacity. The tower, which has a diameter of 8 m and a height of 20 m, is at present being constructed. At the maximum storage level the tower is submerged by 8.5 m. Flow through the tower accounts for about 10% of the discharge through the spillway. (Baker-IVI)
W86-01689

ENERGY APPROACH TO ESTIMATING SCOUR DOWNSTREAM OF A LARGE DAM,
Vancouver (British Columbia).
K. J. W. Spurr.
International Water Power and Dam Construction, Vol. 37, No. 7, p 81-89, July, 1985. 6 Fig, 3 Tab, 52 Ref.

Descriptors: *Scour, *Estimating, *Dam, Fluid mechanics, Water flow, Design criteria, Plunge pools, Spillways.

The prediction of scour is presented for estimating the equilibrium scour downstream of large dams is necessary to ensure the safety of the toe of the dam as well as stability of its abutments. To assess plunge pool scour accurately, the influence of the spillway layout, the spill duration, the geology and the relative rates of scour developent between the outer pool and the live-scour hole must be taken into account. A rationalized, indexed approach is presented for estimating scour downstream of large dams in terms of the mean surplus jet power and rock threshold energy levels. Although the method proposed could have been more usefully illustrated had the necessary equilibrium spill times, hydraulic and geological data at another large dam been available for checking, this approach offers an advantage over previous procedures. (Baker-IVI)
W86-01694

8C. Hydraulic Machinery

MECHANICAL EQUIPMENT OF THE DNESTER MULTIPURPOSE HYDROPOWER DEVELOPMENT,
M. V. Beketov, Ya. S. Oservaser, and B. A. Fedorov.
Hydrotechnical Construction, Vol. 18, No. 11, p 525-528, November, 1984. 3 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 10-12, November, 1984.

Descriptors: *Mechanical equipment, *Dam construction, *Hydroelectric plants, Cranes, Gates.

The Dnester multipurpose hydropower development located on Dnester River in the Chernovtsy region is intended for power generation, irrigation, water supply, and flood control. The mechanical equipment employed was designed with consideration of its use in the construction period and has a number of distinctive characteristics. The construction of a trestle with the service gantry cranes on the gated wall of the upper pool made it possible to operate the gates before construction was completed, which provided start-up of all units on time. Unlike the traditional designs, these cranes have two-legged portals and the grabs have a sectional construction. This made it possible to reduce the weight by 203 tons. The use of service gates during construction eliminated the construction of additional temporary flashboards and corresponding consumption of metals. The use of structural elements of the concrete-buggy trestle of the Sayano-Shushenkoe hydrostation instead of the earlier specified reinforced-concrete elements of the bridge and crane beams considerably simplified fabrication and shortened the assembly time. The timely design developments for the mechanical equipment in the construction period, correlated to the actual conditions at the construction site, made it possible to accomplish the assembly works in the shortest possible time. (Shieh-IVI)
W86-01624

RESULTS OF INVESTIGATING THE EFFECT OF CAVITATION IN HYDROABRASIVE WEAR OF ELEMENTS OF THE WATER PASSAGEWAY OF AXIAL-FLOW PUMPS,
M. M. Mamazhonov, and A. I. Denisov.
Hydrotechnical Construction, Vol. 18, No. 11, p 544-553, November, 1984. 10 Fig, 1 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 22-27, November, 1984.

Descriptors: *Cavitation, *Turbidity, *Pumps, *Abrasion, Hydraulic machinery, Turbines, Suspended sediments, Suction head, Costs.

On-site observation of the operation of hydraulic machines and long experience in operating stations and pumping stations show that abrasive and cavitation-abrasive wear play the main role in the failure of parts of hydraulic turbines and pumps operating on streams with high turbidity. Data is presented which was derived from an experimental facility designed to study the combined effects of cavitation and abrasion due to sediments on failure of hydraulic turbines and pumps. A definite effect of solid particles on the development of cavitation phenomena was found. General principles of selecting the permissible cavitation margin or permissible suction head from the viewpoint of minimum wear rate of pump parts are established. This in turn will impact upon the capital investments required for the construction of pump units. (Keenan-IVI)
W86-01628

NOISE IN THE WATER INDUSTRY,
R. Hobbs.
Water and Waste Treatment, Vol. 28, No. 6, p 10-11, June, 1985. 2 Fig, 1 Tab.

Descriptors: *Noise, *Hydraulic equipment, *Water conveyance, Mechanical equipment, Design criteria,.

There are practical cost effective solutions to combat the problem of noise generated in the water industry due to the movement of water by various mechanical devices. Noise related problems fall into two distinct categories, occupational and involving the employees; and community involving the neighbors. Case studies reveal that even the most difficult projects can be engineered for noise control. These results are not achieved by luck, they are planned for and designed for. When faced with a noise problem whether occupational or community the water authorities can have confidence in the performance of noise reduction and acoustic treatments. (Baker-IVI)
W86-01633

PREVENTING CAVITATION WITH MULTISTAGE ORIFICES,
S. H. Lin.
Hydrocarbon Processing, Vol. 64, No. 7, p 93-95, July, 1985. 2 Tab, 2 Ref.

Field 8—ENGINEERING WORKS

Group 8C—Hydraulic Machinery

Descriptors: *Cavitation, *Multistage orifices, Orifices, Erosion control, Water flow, Fluid mechanics, Hydraulics.

A multistage orifice is essentially a series of sharp-edged orifices installed in a line. It prevents cavitation by gradually reducing the pressure. If designed properly, it is highly effective, inexpensive and easy to fabricate when compared to other sophisticated devices. Two types of multistage orifice design are considered. The first type is constant-cavitation index design, and the second is constant-orifice diameter design. The first type of design is to determine the number of orifice stages with such a constant cavitation index so that the given upstream and downstream pressure heads are satisfied. For this case, the pressure drop across an orifice and the orifice diameter will vary from stage to stage. The second type of design utilizes a constant orifice diameter for all orifices and allows the cavitation index to vary. (Baker-IVI)
W86-01721

8D. Soil Mechanics

EFFECT OF LEACHING ON THE INTEGRITY OF A NATURAL CLAY,
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
For primary bibliographic entry see Field 5E.
W86-01457

PHYSICAL AND CHEMICAL BEHAVIOUR OF CLAY-BASED BARRIERS UNDER PERCOLATION WITH TEST LIQUIDS,
Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Grundbau und Bodenmechanik.
For primary bibliographic entry see Field 5G.
W86-01458

COMPACTION CHARACTERISTICS OF RIVER TERRACE GRAVEL,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
V. K. Garga, and C. J. Madureira.
Journal of Geotechnical Engineering, Vol. 111, No. 8, p 987-1007, August, 1985. 15 Fig, 6 Tab, 12 Ref.

Descriptors: *Compaction, *Gravelly soils, *Construction materials, *Earth dams, *Dams, Permeability, Particle size, Soil types, Soil properties.

Gravelly soils consisting of sound gravel-size particles in a matrix of finer material have proved to be a satisfactory construction material for several large earth dams. The gravel fraction of these soils imparts a relatively high shear strength, high compacted density and low compressibility, while the permeability of the soil is governed by the properties of the matrix material. Large-scale field and laboratory tests were carried out to investigate compaction characteristics of a river terrace gravel soil at the 120-m high Sao Simao Dam in Brazil where approximately 10,000,000 cu m of this material were used as compacted fill. The course fraction of the deposit was typically 3 in. (7.5 cm) maximum size, while the matrix (defined as material passing No. 4 sieve) was basically a clayey sand with LL = 30-35%, PI = 5-15 and 35-50% passing the No. 200 sieve. Field compaction trials were carried out to establish procedures for embankment construction and to evaluate the efficiency of two vibratory rollers. The maximum density for a specific compaction effort was obtained at a gravel content of 65-70%. Shockley's expression for maximum density is not valid for gravel content greater than 25%. The particle size does not significantly affect compaction for gravel content in the 40-60% range for the equipment used in this study. The measured densities are insensitive to the gradation of the gravel fraction. Field compacted density control can be exercised satisfactorily by using elimination and substitution methods: In the substitution method, the plus 3/4 in. fraction size is substituted in a sample by an equal percentage of minus 3/4 in. to plus No. 4 sieve size fraction, and compacted using the intermediate energy; in the elimination method, only the minus 3/4 in. size fraction in a sample is compacted using the standard Procter energy. (Collier-IVI)
W86-01532

REDUCTION OF THE TIME OF PLACING MATERIALS IN THE CONSTRUCTION OF THE DAM AT THE ROGUN HYDROELECTRIC STATION,
T. I. Adam'yants, E. P. Karpoy, and S. Y. Lashchenov.
Hydrotechnical Construction, Vol. 18, No. 11, p 520-525, November, 1984. 4 Fig, 1 Tab, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 6-9, November, 1984.

Descriptors: *Earth dams, *Dam construction, Rollers, Vibrators, Construction, Earthworks, Construction equipment.

The placement of materials in the dam is the main factor determining the rate of construction in the cyclic production-line technology used for construction of the earth-rock dam at the Rogun hydrostation. Because the geotechnical characters of the materials being used at the Rogun hydrostation are similar to those of Nurek dam, the experience of constructing the dam at the Nurek hydrostation is the basis for recommendations on the parameters and technological operating regimes of vibrating rollers and on the organization of the next investigations for advanced development of the optimal technology for construction of the earth-rock dam at the Rogun hydrostation. To increase the rate and reduce the work time for placing materials in the Rogun dam it is necessary to provide intensive methods of placing the earth materials in layers > 1 m thick with rolling speeds up to 4 km/h and reduction of the number of passes with overlapping by using effective vibrating machines. It is necessary to be oriented mainly towards the use of medium (5-10 tons) and heavy (10-15 tons) mobile vibrating rollers. The parameters and technological operating conditions of the rollers should be refined based on the results of experimental rolling. (Shieh-IVI)
W86-01623

LIQUEFACTION OF FINE SAND DUE TO WAVE ACTION,
Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ingenieria.
L. Zeevaert.
Shore and Beach, Vol. 51, No. 2, p 32-36, April, 1983. 6 Fig.

Descriptors: *Liquefaction, *Sand, *Waves, *Grijalva River, *Mexico, Erosion, Jetties, Clay, Subsidence, Sediment transport, Erosion.

In connection with an investigation for the construction of two new long jetties at the mouth of the Grijalva River in order to permit safe navigation to reach the Port of Frontera in the State of Tabasco, Mexico, liquefaction in fine sand was also studied. Subsoil investigations indicated a surface deposit of about 5 mts thick of the fine sand with a mean diameter ranging between 0.15 and 0.20 mm. From 10 to 29.5 mts depth a thick bluish-gray clay deposit with microscopic shells was encountered and is underlain by gray silty snd with small shells. The average water content of the clay deposit is about 55% and is practically constant with depth. The shearing strength of the clay deposit, between 10 and 29.5 mts depth, was obtained from unconfined compression tests and showed an erratic value, probably because of the strong difference in the salinity of the water during the process of sedimentation and flocculation of the fine grains. The large subsidence of the rock jetties found may be attributed only to the simultaneous action of spontaneous liquefaction and base erosion. Instantaneous liquefaction may be visualized as a pumping action produced by the waves in the fine sand at the toe of the jetty, permitting a gradual subsidence of the rock into the sand up to a depth where the effective stress in the sand is greater than zero. The water flow at the foundation grade elevation of the jetty facilitated the transport of the fine sand, permitting the spreading of the rock slope of the jetty because of the reduction in the foundation support. (Baker-IVI)
W86-01845

8E. Rock Mechanics and Geology

RESULTS OF EXPERIMENTAL DRILL AND BLASTING OPERATIONS IN PRE ING THE ROCK FOUNDATION OF THE PIVINSKII HYDROELECTRIC STATION,
A. E. Azarkovich, and V. N. Yanovskii.
Hydrotechnical Construction, Vol. 18, No. 529-533, November, 1984. 3 Fig, 3 Tab, 6 Translated from Gidrotekhnicheskoe Stroitel No. 11, p 12-15, November, 1984.

Descriptors: *Blasting, *Foundation rocks, * construction, Dam foundations, Hydroel plants, Foundations, Blasthole charges.

Drilling and blasting operations near the contour of the foundation pits of importan draulic structures should be performed so tha necessary preservation of the rock foundati provided. A new method of calculating the pa eters for blasting is evaluated. The objective new method is to allow loosening of the lay rock directly above the foundation contou reduced blasthole charges rather than by sho charges. The suitability of the new method confirmed by blasting at the Krapivinskii hyd tion. The methods of investigation used di show disturbance of the foundation after the b (Keenan-IVI)
W86-01625

8F. Concrete

PERFORMANCE OF WATER PIPELINE TERIALS,
R. L. Klein, and A. J. Rancombe.
Chemistry and Industry, Vol. 11, p 353-358, 15 Ref.

Descriptors: *Pipelines, *Water supply, *W distribution, *Cement, Construction mate Concrete, Corrosion, Iron, Bacteria, Joints.

The performance of the principal materials in eral use for water supply pipelines has bee viewed. It will be evident that no single mate without its shortcomings and that, despite co erable advances in technology, the hazards as ated with each material remain imperfectly u stood, as do the most appropriate methods of coming them. Ductile iron is an excellent ma which in most circumstances can be expecte give long and trouble-free service. But, inste the half measures of zinc spraying and polye ene sleeving, the industry should be looking more durable method of coating. Cement m lining will in most cases last as long as the pipe may be vulnerable to very soft waters. Pe fusion bonded epoxy or some similar plastic sy will in the future take the place of present met of protection. Steel pipe, generally the only m al appropriate to high pressure transmission m is unsuitable for distribution purposes for two sons: the full strength of the material is not uti at low pressures and the pipe is therefore un nomical. Secondly, the application of cathodic tection is impracticable in an urban environ because of interference with other services. prestressed concrete amd asbestos cement will give good long term service in most circ stances, but it is disappointing that manufact have not applied themselves more diligentl developing protective coatings which will gua tee performance in environments corrosiv cement. (Baker-IVI)
W86-01611

WAYS TO IMPROVE THE TECHNOLOGY CONSTRUCTING CONCRETE HYDRAU STRUCTURES,
A. D. Osipov.
Hydrotechnical Construction, Vol. 18, No. 517-520, November, 1984. 1 Tab, 1 Ref. Transl

drotekhnicheskoe Stroitel'stvo, No. 11, p
ember, 1984.

ors: *Hydraulic structures, *Concrete
gy, Arch dams, Dam construction, Rolled
Retaining walls, Reinforced concrete,
additives.

r of measures have been taken recently in
ruction of high arch dams in order to
igh-strength concrete and solidity of the
masonry. However, the implementation
easures significantly increases the cost of
masonry of a dam. Several new ap-
can be taken to reduce the cost, construc-
and labor expenditures associated with
uction of concrete dams. When constuct-
retaining walls, and other massive struc-
possible to use a very stiff low-cement
ncrete (80-100 kg/cu m) placed in thin
a large area. The use of such concretes in
truction makes it possible to eliminate
frequent sectionalizing into blocks and
sures for controlling thermal stresses. All
d reinforced-concrete structures should
f poured self-compacting concrete mixes
by concrete pump with the use of plasti-
d air-entraining additives, which will
ssible to have the required physical and
l properties of concrete without the
mption of cement. Stiff fine-grained con-
es placed and compacted by rotary
or vibrating rollers should be used for
he slopes of earth structures. (Shieh-IVI)
2

terials

LIC CONDUCTIVITY OF TWO PRO-CLAY LINERS,

Inc., Pittsburgh, PA.
ry bibliographic entry see Field 5G.

IVE COATINGS FOR WATER STOR-KS AND WATER TREATMENT FA-

nical Co., Edison, NJ.
y, and J. Zawacki.
the New England Water Works Asso-
l. 99, No. 2, p 164-186, June, 1985. 8

: *Water storage tanks, *Water treat-
ties, *Coatings, Requirements, Specifi-
ater tanks.

otective coating job requires the team-
veral people, the engineer, the applica-
tings manufacturer, and the inspector.
ne many considerations regarding the
nd use of protective coatings in water
nd storage facilities are presented. Spe-
considered include: a properly written
ecification, surface preparation, proper
nd paint systems. (Baker-IVI)

eries Engineering

OF ANNUAL DRAINING ON UALITY AND PRODUCTION OF CATFISH IN PONDS,

v., AL. Dept. of Fisheries and Allied
es.
rman, and C. E. Boyd.
, Vol. 46, No. 1, p 45-54, May, 1985. 5
16 Ref.

*Aquaculture, *Catfish ponds,
aining, *Fish farming, Catfish farming,
y, Chlorophyll a, Phosphorus, Chemi-
demand, Nitrates, Nitrites, Ammonia,

ns of chlorophyll a, total phosphorus,
xygen demand, nitrite-nitrogen, total
rogen, and dissolved oxygen were
equently in channel catfish ponds, of

which four were drained annually and four were not drained for 3 years. Average concentrations of total phosphorus increased from year to year in undrained ponds, and they were higher ($P < 0.01$) in undrained ponds than in drained ponds during the second and third years of the study. Phytoplankton abundance, as evident from chlorophyll a concentrations, did not differ ($P > 0.05$) within or between treatments during the 3 years. Water quality was similar between treatments. One difference in production of channel catfish occurred during the third year and was related to a parasite infection of fish rather than water quality. The findings suggest that the recent trend in not draining channel catfish ponds at harvest will not lead to rapid deterioration of water quality in ponds. (Author's abstract)
W86-01322

SETTING OF THE AMERICAN OYSTER CRASSOSTREA VIRGINICA IN THE JAMES RIVER, VIRGINIA, USA: TEMPORAL AND SPATIAL DISTRIBUTION,

Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 2L.
W86-01504

FACTORS AFFECTING GROWTH AND RECRUITMENT OF YELLOW PERCH, PERCA FLAVESCENS MITCHILL, IN SOUTH BAY, LAKE HURON,

Ontario Ministry of Natural Resources, Toronto. Lake Huron Fisheries Research Unit.
B. A. Henderson.
Journal of Fish Biology, Vol. 26, No. 4, p 449-458, April, 1985. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Perch, *Lake Huron, *Recruitment, *Growth, Lakes, Population dynamics, Water temperature, Water level, Fish populations.

Several hypotheses were tested which explain the large variations in recruitment and growth observed in yellow perch. The five hypotheses are: recruitment is positively correlated with water temperature; recruitment is a function of parental stock-size; recruitment is a function of water levels; growth is related to population abundance; and growth is dependent upon water temperature. The ratio of recruits to spawners was principally determined by variations in water levels, which presumably reflected the effect of variations of the quality and quantity of spawning substrates on egg or fry survival. The recruitment was then dependent upon the combination of stock-size and the survival of the eggs or fry. Thus, good recruitment could only be achieved if a large parental stock size produced eggs that survived well. In recent years, the parental stock-size in South Bay was small, but the survival was good; as a result, the recruitment was relatively poor compared with the earlier years when both parental stock-size was large and early survival was high. There was no indication that recruitment and the ratio of recruits to spawners was dependent upon stock density; therefore, a stock-recruitment relationship did not exist. Variations in R/P were a function of water levels and not parental stock-size. Growth was not dependent upon water temperatures, but was affected by population abundance. The number of recruits, and not the total population size determined the rate and increment of growth. The implication is that competition for food takes place between perch of a similar size and age. The environment determined the ratio of recruits to spawners, and the population size affected growth. (Baker-IVI)
W86-01508

ESTIMATING THE POPULATION DYNAMICS OF COHO SALMON (ONCORHYNCHUS KISUTCH) USING POOLED TIME-SERIES AND CROSS-SECTIONAL DATA,

Rhode Island Univ., Kingston. Dept. of Resource Economics.
For primary bibliographic entry see Field 2H.
W86-01585

WATER TEMPERATURE AS THE PRIMARY INFLUENCE ON TIMING OF SEAWARD MIGRATIONS OF ATLANTIC SALMON (SALMO SALAR) SMOLTS,

Direktoratet for Vilt og Ferskvannsfisk, Sandnes (Norway). Forskningsstasjion for Ferskvannsfisk.
For primary bibliographic entry see Field 2H.
W86-01589

RESERVOIR FISHERY RESEARCH NEEDS AND PRIORITIES,

Tennessee Valley Authority, Chattanooga.
G. E. Hall.
Fisheries, Vol. 10, No. 2, p 3-5, March-April, 1985. 17 Ref.

Descriptors: *Fisheries, *Management, *Reservoir fisheries, Operation, Planning, Reservoir operation, Fish stocking, Water quality, Surveys, Research priorities.

In surveys conducted in 1983 and 1984 approximately 80 professional fisheries biologists with reservoir experience were asked to furnish information and ideas on gaps in current reservoir knowledge, pressing needs for additional information, appropriate directions for research and the kind of organization best suited to conduct a reservoir fisheries program. Knowledge gaps identified by the largest number of respondents in both surveys were: the absence of a clear understanding of predator/prey interactions; need for information on optimum stocking procedures; knowledge of factors affecting the recruitment of fish; and information concerning impacts of harvest regulations on individual species and population balance. Highest priorities for needed information concerned a better knowledge of water quality/fish interactions and the ability to predict impacts of reservoir drawdowns and/or water level fluctuations plus more information on proven reservoir management techniques. The majority of respondents thought the development of models for managing reservoir problems should receive the greatest attention. Over 90% of the survey respondents considered reservoir research to be a federal responsibility. Although most of the respondents felt that reservoir research was a federal responsibility deserving national attention, there is a lack of concensus concerning how it should be funded and administered. (Baker-IVI)
W86-01598

MANAGEMENT OF LACUSTRINE FISHERIES IN THE TROPICS,

Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
R. T. Oglesby.
Fisheries, Vol. 10, No. 2, p 16-19, March/April, 1985. 2 Tab, 15 Ref.

Descriptors: *Fish management, *Reservoirs, *Tropical regions, Resources management, Fish populations, Fisheries, Developing countries, Regional development.

Lake and impoundment fisheries of many developing countries have the potential to provide accessible, relatively inexpensive animal protein in quantities approaching a hundred kilograms per hectare of surface per year. These fisheries in the lowland tropics currently yield an average catch of 80 kg/ha/hr. There are two kinds of harvest limitations: those imposed by constraints on fish production and those resulting from underdevelopment of fisheries. A first, critical step in the management of these fisheries is to predict potential yields and to compare them with current harvests. Site specific management programs can then be developed by taking into account stocking, assistance to fishermen, data collection and analysis, and program evaluation. Most impoundments now being built or planned in developing countries are primarily for the production of power and the storage of water for crop irrigation. Fisheries are an add-on and their management becomes complicated by the presence of trees not removed during site preparation and extreme water level fluctuations that occur both seasonally and between years. Inclusion of fishery personnel in making operation decisions as well as in initial planning activities may result in substantially improved fishery development oppor-

tunities. Management of lake and impoundment fisheries in developing tropical countries is at an early stage but seems to be evolving rapidly. (Collier-IVI)
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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 19, NUMBER 6
JUNE 1986

-- W86-02419
SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 19, NUMBER 6
JUNE 1986

W86-01920 -- W86-02419

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1986.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

ONDUCTANCE: A COLLECTIVE MEASURE OF DISSOLVED IONS,
Geological Survey, Menlo Park, CA.
D. Hem.
N: Water Analysis, Academic Press, Orlando, FL. 982, Volume 1: Inorganic Species, Part 1. p 137-61, 7 fig, 28 ref.

escriptors: *Conductance, *Physical properties, Chemical properties, *Conductivity, *Specific nductivity, Dissolved solids, Natural waters, Sa-nity, Ions, Irrigation water, Trace elements, Phy-ochemical properties.

he physical basis for electrical conductance in ueous solutions, the influence of solute concen-ations and related factors on conductance, and e ways in which these influences are evaluated e examined. The specific conductance of a sub-nce is the conductance over 1 cm of a segment the material having a cross-sectional area of 1 sq . The equivalent conductance of a solute is the nductance of one gram of the material dissolved water. Major factors affecting limiting equiva-nt conductances include ionic size, charge and eed. Increased temperatures bring about in-eased ion movement. Conductivity cells usually ve platinum electrodes. Compensations that can made for temperature effects, and types of easuring instruments are described. Conductivity lues are related to salinity and have been used to aluate the usability of water for irrigation or er purposes or the need for correcting undesir-e salinity levels in soils. The conductivity of ural waters varies considerably depending upon solved solids content. Conductivity measure-nts may also be applied to the calculation of al ionic concentrations in equivalents per liter, estimation of ionic strength of solutions, and estimation of the gravimetric dissolved solute ncentration. (Geiger-PTT)
6-02261

2. WATER CYCLE

A. General

TER RESOURCES AND EFFECTS OF DE-LOPMENT IN HERNANDO COUNTY, ORIDA,
ological Survey, Tampa, FL. Water Resources
. Fretwell.
ilable from OFSS, USGS, Box 25425 Lake-od, CO 80225. USGS Water-Resources Investi-ons Report 84-4320, 1985. 83 p, 33 fig, 7 tab, 61

criptors: *Groundwater, *Water supply, Water ity, *Saltwater intrusion, Karst Floridan aqui-system, Hernando County, *Florida.

pite of the hill and valley terrain in the Brooks-Ridge area of Hernando County, Florida, surface drainage occurs within the county. harge to the Floridan aquifer system occurs as tration of precipitation within the county or as nd-water flow from Sumter County to the east Pasco County to the south. Discharge is prin-lly to the Gulf of Mexico, but some ground r flows north into Citrus County before it hes the Gulf. The Floridan aquifer system is rally unconfined. Water quality is generally l except near the coast where high chloride rs. Water from the Floridan aquifer system unted for 87 percent of the water used for ation, industry, and rural and public supply in . Sixty-seven percent of this water was used ndustry. Rock mining, the major industry, used ercent of the industrial water. The anticipated ease in population in the county between 1982 2000 will increase demand for water primarily public water-supply systems. This higher demand will cause about a 1 percent reduction in flow from Weeki Wachee Springs, but little change in lake levels or saltwater intrusion will occur if the projected additional supplies are developed far enough inland from the coast. (USGS)
W86-01931

HABITAT SUITABILITY INDEX MODELS: REGRESSION MODELS BASED ON HARVEST OF COOLWATER AND COLDWATER FISHES IN RESERVOIRS,
Fish and Wildlife Service, Fayetteville, AR. National Reservoir Research Program.
L. R. Aggus, and W. M. Bivin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-147348, Price codes: A03 in paper copy, A01 in microfiche. Report FWS/OBS-82/10.25, September 1982. 38 p, 1 fig, 5 tab, 14 ref, 4 append.

Descriptors: *Habitat, *Fisheries, *Reservoir fisheries, *Mathematical models, *Fish harvest, Reservoirs, Fish, Lake fisheries, Regression analysis, Models, Model studies.

Habitat suitability index models were developed for selected coolwater and coldwater fishes in reservoirs. The models were based on estimates of harvest and were designed for use in existing and proposed coolwater and coldwater reservoirs in the contiguous United States. The analysis of reservoir harvest data consisted of development of multiple regression equations to predict harvest of selected fishes; conversion of these values to indices of habitat suitability; and exploration of discriminant analysis as an alternate quantitative approach. The feasibility of classifying reservoirs on the basis of grouped harvest of selected sport fishes, then predicting group membership based on environmental characteristics of a reservoir was also tested with discriminant analysis. The multiple regression equations presented herein are easily programmed to permit users to input environmental data and receive harvest and cumulative frequency values as output. The use of environmental factors to predict harvest in coolwater and coldwater reservoirs may remain relatively imprecise. Discriminant analysis did not produce precise classification schemes in reservoirs. Quantitative methods for identifying appropriate levels of harvest should be sought and tested before the procedure is abandoned. (Geiger-PTT)
W86-01985

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN GROUNDWATER MODELING: SELECTION, TESTING AND USE,
Michigan Dept. of Natural Resources, Lansing.
For primary bibliographic entry see Field 2F.
W86-02034

RAINFALL-RUNOFF RELATIONSHIPS AND WATER-QUALITY ASSESSMENT OF COON CREEK WATERSHED, ANOKA COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
A. D. Arntson, and L. H. Tornes.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4013, 1985. 97 p, 17 fig, 17 tab, 42 ref.

Descriptors: *Rainfall-runoff relationships, *Hydrograph modeling, Streams, Antecedent moisture, HEC-1, Water quality, Urbanization, Chemical properties, Biological properties, Regression techniques, Bottom materials, Loading, Sediment, Coon Creek, Anoka County, *Minnesota, Anoka Sand Plain.

Rainfall-runoff relationships were studied and a water-quality assessment was done for the 96.9-square-mile Coon Creek watershed, Anoka County, Minnesota. Data were collected from March 1979 to November 1980 at three continuously recording rainfall sites, five continuously recording streamflow sites, and seven creststage sites. Hydrograph analyses showed larger peak flows, shorter times to peak, and shorter duration of high flows in streams draining urban areas than in streams draining rural areas. Constrictions at roadways resulted in attenuation of hydrograph peaks in urban areas. Eight storms produced 19 hydrographs suitable for simulation with the HEC-1 model program. Parameter-optimization techniques were used to produce synthetic hydrographs that closely resemble observed hydrographs. Linear regression was used to relate rainfall and antecedent-moisture conditions in each of the subbasins to HEC-1 input parameters, resulting in generalized models that satisfactorily match 15 of 19 observed hydrographs. Water quality was determined from 1 bottom-material and 14 water samples from each of 4 sites. Results showed that urban runoff carried the highest areally adjusted loads of several metals, chloride, dissolved solids, and suspended sediment. The highest areally adjusted loads of most nutrients were found in mainstem segments of streams in rural areas. (USGS)
W86-02370

APPLICATION OF THE U.S. GEOLOGICAL SURVEY'S PRECIPITATION-RUNOFF MODELING SYSTEM TO THE PRAIRIE DOG CREEK BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
L. E. Cary.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4178, 1984. 98 p, 16 fig, 30 tab, 64 ref.

Descriptors: *Parametric hydrology, Hydrologic models, Model Studies, Model testing, *Rainfall-Runoff relationships, *Semiarid lands, Prairie Dog Creek basin, Tongue River basin, *Montana.

The U.S. Geological Survey's precipitation-runoff modeling system was tested using 2 year's data for the daily mode and 17 storms for the storm mode from a basin in southeastern Montana. Two hydrologic response unit delineations were studied. The more complex delineation did not provide superior results. In this application, the optimum numbers of hydrologic response units were 16 and 18 for the two alternatives. The first alternative with 16 units was modified to facilitate interfacing with the storm mode. A parameter subset was defined for the daily mode using sensitivity analysis. Following optimization, the simulated hydrographs approximated the observed hydrograph during the first year, a year of large snowfall. More runoff was simulated than observed during the second year. There was reasonable correspondence between the observed snowpack and the simulated snowpack the first season but poor the second. More soil moisture was withdrawn than was indicated by soil moisture observations. Optimization of parameters in the storm mode resulted in much larger values than originally estimated, commonly larger than published values of the Green and Ampt parameters. Following optimization, variable results were obtained. The results obtained are probably related to inadequate representation of basin infiltration characteristics and to precipitation variability. (USGS)
W86-02390

CALIBRATION PROCEDURE FOR A DAILY FLOW MODEL OF SMALL WATERSHEDS WITH SNOWMELT RUNOFF IN THE GREEN RIVER COAL REGION OF COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. M. Norris, and R. S. Parker.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4263, 1985. 32 p, 18 fig, 8 tab, 10 ref.

Descriptors: *Model studies, *Snowmelt, *Calibrations, Soil water, *Runoff prediction, *Colorado, *Precipitation-Runoff Modeling System.

A calibration procedure was developed for the U.S. Geological Survey's Precipitation-Runoff Modeling System for watersheds in which snowmelt is the major contributor to runoff. The model uses daily values of air temperature and precipita-

tion as input and the output is mean daily discharge. The procedure appears sufficient to calibrate both streamflow volume and the timing of mean daily discharge if other model parameters are reasonably estimated. Model structure and sensitivity analysis suggest that one of the most important parameters is the available water-holding capacity of the soil (SMAX). Changing this parameter through a series of iterations, the calibration procedure minimizes the error between observed and predicted annual discharge. The calibration suggests that the single parameter SMAX may be sufficient for optimizing both the volumes and the timing of runoff, assuming other model parameters are adequately estimated. Additional optimization on parameters sensitive to timing does not appear to improve prediction. This indicates that these parameters were estimated accurately prior to calibration. Further investigation is needed on more watersheds to determine SMAX's ability to calibrate volume and timing with a constant set of other model parameter values. (USGS)
W86-02403

2B. Precipitation

SCPP DATA COLLECTION AND ANALYSIS FOR THE PERIOD 1 JANUARY 1979 THROUGH 30 SEPTEMBER 1984: VOLUME ONE - EXECUTIVE SUMMARY,
Atmospherics, Inc., Fresno, CA..
Final Report, September 1984. 35 p, 1 fig. 9-07-85-V0020.

Descriptors: *Weather modification, *Precipitation, *Data collections, Orographic precipitation, Supercooling, Meteorological data collections, Cloud physics, Cloud seeding, *Sierra Cooperative Pilot Project, Sierra Nevada Mountains, Measuring instruments, Snow, Ice, *California.

This volume (1 of 3) briefly summarizes all weather modification data collection and analysis tasks performed by Atmospherics Incorporated during the period 1 January 1979 through September 1984 within the Sierra Cooperative Pilot Project. The major categories of work included the installation, operation, and maintenance of, plus data collection and analysis from (1) a network of precipitation gages, (2) ground-based instrumentation for the detection of supercooled liquid water, (3) a network of surface meteorological stations, (4) a fixed microphysics station, (5) snow and high-volume air samplers and (6) NCAR Ice Nucleus counters. Summaries of work performed during the six seasons of field activities, including data acquition, data processing, instrument calibration, and maintenance and anlaysis efforts, are presented. (Author)
W86-01984

THUDERSTORMS: A SOCIAL, SCIENTIFIC, AND TECHNOLOGICAL DOCUMENTARY. VOLUME 3: INSTRUMENTS AND TECHNIQUES FOR THUNDERSTORM OBSERVATION AND ANALYSIS.
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146076, Price codes: A14 in paper copy, A01 in microfiche.
April 1982. Edited by Edwin Kessler. 313 p.

Descriptors: *Thunderstorms, *Radar, *Data acquisition, *Satellite technology, *Meteorological data collections, Storms, Tornadoes, Rainstorms, Photogrammetry, Hail, Networks, Acoustics, Data collections, Weather data collections, Instrumentation, Networks.

This third and last volume of a comprehensive documentation of thunderstorms presents tools and techniques for acquisition and analysis of data on thunderstorms. Topics covered include: station networks for storm observation, tornado interception with mobile teams, observations from instrumented aircraft, photogrammetry of thunderstorms, storm acoustics, infrasound from thunderstorms, sferics and other electrical techniques for storm investigations, observation and measurement of hailfall, and the use of satellite observations. An appendix to the chapter on measuring storm rainfall is included which provides mathematical equations to adjust for various biases caused by receivers, rainfall, attenuation, clouds and atmospheric gases. (Geiger-PTT)
W86-02003

STATION NETWORKS FOR STORM OBSERVATION,
National Weather Service, Sterling, VA. Test and Evaluation Div.
For primary bibliographic entry see Field 7B.
W86-02004

OBSERVATIONS FROM INSTRUMENTED AIRCRAFT,
National Oceanic and Atmospheric Administration, Boulder, CO. Weather Modification Program Office.
For primary bibliographic entry see Field 7B.
W86-02005

OBSERVATION AND MEASUREMENT OF HAILFALL,
National Center for Atmospheric Research, Boulder, CO. Convective Storms Div.
For primary bibliographic entry see Field 7B.
W86-02007

QUALITY AND QUANTITY OF URBAN RUNOFF AND ATMOSPHERIC DEPOSITION IN URBAN AREAS OF SALT LAKE COUNTY, UTAH, 1980-1981,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02346

FLOODS OF APRIL 18, 1983 ON ST. THOMAS AND ST. JOHN, U.S. VIRGIN ISLANDS,
Geological Survey, San Juan, PR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02362

2D. Evaporation and Transpiration

APPLICATION OF A PLANT-ENVIRONMENT MODEL TO PROBLEMS IN IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W86-02128

INSTRUMENTATION FOR MEASURING LAKE AND RESERVOIR EVAPORATION BY THE ENERGY-BUDGET AND MASS-TRANSFER METHODS,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-02379

2E. Streamflow and Runoff

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1984,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-01926

EVALUATION OF THE SURFACE-WATER DATA NETWORK, SUWANNEE RIVER BASIN, FLORIDA, 1982,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-01936

HYDROLOGY OF AREA 11, EASTERN C PROVINCE, OHIO, KENTUCKY, AND V VIRGINIA,
Geological Survey, Columbus, OH. Wate sources Div.
D. K. Roth, and S. C. Cooper.
Available from OFSS, USGS, Box 25425 wood, CO 80225. USGS Water-Resources In gations Report 84-233, 1984. 66 p, 45 fig, 4 t ref.

Descriptors: *Coal Mines, *Environmental E Mine Drainage, Water Quality, Erosion, Sed tation, *Eastern Coal Province, *Ohio, Kent West Virginia.

The Eastern Coal Province is divided in separate hydrologic reporting areas. The di is based on hydrologic factors, location, size mining activity. Area 11 of the Eastern Coal ince comprises 3,190 square miles of southea Ohio, northeastern Kentucky, and western V ia. Except for the wide, flat flood plain alon Ohio River, it consists mainly of rolling hills. of the area is forested. Precipitation in the ranges from 39 inches per year in the north inches per year in the south. Coal seams 1 to thick are found in rocks of Pennsylvanian ag crop out in Area 11. Surface mining of c concentrated in the Ohio part; surface mine scattered throughout the Kentucky part, and are no known mines in the West Virginia Most of the streams that drain less than 100 s miles normally approach zero flow from late through October. The average value of th percent daily duration flow (based on eigh tions) is 0.37 cubic feet per second per square The 2-year flood-peak magnitude (based on stations) ranges from 10.8 to 138 cubic fee second per square mile; the average 2-year peak is 43.8 cubic feet persecond per square The pH of sampled streams ranged from 2.6 t The median pH at mined sites was 5.4 where median pH at unmined sites was 7.3. Disso iron concentrations ranged from 0 to 150,00 crograms per liter; medians were 893 microg per liter at mined sites and 90 micrograms pe at unmined sites. Sulfate concentrations ra from 9.8 to 2,100 milligrams per liter; me were 203 milligrams per liter at mined sites a milligrams per liter at unmined sites. Alth water wells in alluvium along the Ohio produce up to 1,500 gallons per minute, bed wells throughout most of Area 11 typically only 1 or 2 gallons per minute. Chemical ana of ground water indicate that bicarbonate i major anion in Area 11; calcium and sodium the major cations. (USGS)
W86-01937

EFFECTS OF URBANIZATION OF TH PONDS IN MIDDLETON, WISCONSIN,
Geological Survey, Madison, WI. Water sources Div.
For primary bibliographic entry see Field 4C.
W86-01949

EVALUATION OF RAINFALL-RUNOFF D FOR THE DENVER FEDERAL CENT LAKEWOOD, JEFFERSON COUNTY, CO RADO,
Geological Survey, Lakewood, CO. Water sources Div.
R. D. Jarrett, and J. E. Veenhuis.
Available from OFSS, USGS Box 25425 L wood, CO 80225. USGS Water-Resources Inv gations Report 84-4050, 1984. 67 p, 11 fig, 7 ta ref.

Descriptors: *Storm runoff, *Streamflow, W management, *Rainfall-runoff relations, *Hy graph analysis, *Floods, Flow discharge, Thun storms, Streamflow gages, Rain gages, Data lections, Stage-discharge relations, *Colorado, ferson County, Lakewood, Denver Fed Center.

An investigation was made to monitor the st runoff in McIntyre Gulch basin to determine rainfall-runoff chracteristics. Results may now used to evaluate the effects of future developr

on storm runoff from the Denver Federal Center, which is located in the McIntyre Gulch basin in Lakewood, CO. Rainfall and runoff data were collected at eight streamflow stations and three auxiliary rainfall stations in and adjacent to the Denver Federal Center. The outflow peak discharges from McIntyre Gulch in the Denver Federal Center were higher than the inflow peak discharges for eight of the storms by an average of 38 ercent. Outflow peak discharges for eight of the torms were lower by an average of 12 percent. The study demonstrated that runoff varies with ocation of a storm--even for a relatively small asin. Peak discharges of McIntyre Gulch outflow om the Denver Federal Center were 27 percent reater than the inflow for all storms, but only 15 ercent greater for evenly distributed storms. unoff from the Denver Federal Center increased orm-runoff volumes in McIntyre Gulch by an verage of 46 percent. Proper management of orm runoff in the Denver Federal Center reires that proposed improvements to the existing orm-runoff system maintain peak flows at their esent levels. (USGS)
86-01956

ETERMINATION OF REAERATION COEFCIENTS FOR OHIO STREAMS,
eological Survey, Columbus, OH. Water Reurces Div.
Hren.
ailable from OFSS, USGS Box 25425 Lakeod, CO 80225. USGS Water-Resources Investitions Report 84-4139, 1984. 25 p, 1 fig, 3 tab, 10

escriptors: *Aeration, *Ohio, Streams, *Reaeran, Regression analysis, Tracers, *Reaeration coicients, Hydrocarbon tracers.

e hydrocarbon gas tracer technique was used to ermine reaeration coefficients on 30 reaches of io streams. The studies were done from Septem- 1979 through August 1982 to determine the eration coefficients for the individual reaches l to develop general equations that could be d to estimate the coefficients. Multiple linear ression was used to determine relationships ong the reaeration coefficients and physical am characteristics. Four special equations ed on the general information were developed n various combinations of discharge, slope, th, depth, measured velocity, and estimated city. The standard errors of estimate for these ations ranged from 37 to 46 percent. The varia- that resulted in the lowest standard error of mate were discharge, slope, width, depth, and sured velocity. The most significant variables e depth and velocity. (USGS)
6-01958

ST-EFFECTIVENESS OF THE U.S. GEOGICAL SURVEY STREAM-GAGING PROAM IN ARKANSAS,
logical Survey, Little Rock, AR. Water Reces Div.
primary bibliographic entry see Field 7A.
6-01961

MPILATION OF DATA COLLECTED AND RIVED FOR WATER YEARS 1980 AND 1981 THE PURPOSE OF WATER-QUALITY DELING OF THE LOWER OUACHITA ER AND SELECTED TRIBUTARIES, TH-CENTRAL ARKANSAS,
logical Survey, Little Rock, AR. Water Reces Div.
primary bibliographic entry see Field 5B.
-01965

EAMFLOW ROUTING IN THE SCHORIE CREEK BASIN, NEAR NORTH BLENM, NEW YORK,
ogical Survey, Albany, NY. Water Resources

. Wolcott.
lable from OFSS, USGS Box 25425 Lake, CO 80225. USGS Water-Resources Investins Report 84-4054, 1983. 20 p, 4 fig, 3 tab, 7 ref.

Descriptors: *Flood Routing, *River Forecasting, *Model Studies, Historic Flood, Hydrographs, *New York, Schoharie Creek, HEC-1 model.

A flow-routing model of the upper Schoharie Creek basin, New York, was developed and used to simulate high flows at the inlet of the Blenheim-Gilboa Reservoir. The flows from Schoharie Creek at Prattsville, the primary source of flow data in the basin, and tributary flows from the six minor basins downstream, are combined and routed along the 9.7 mile reach of the Schoharie Creek between Prattsville and the reservoir inlet. Data from five historic floods were used for model calibration and four for verification. The accuracy of the model as measured by the difference between simulated and observed total flow volumes, is within 14 percent. Results indicate that inflows to the Blenheim-Gilboa Reservoir can be predicted approximately 2 hours in advance. One of the historical floods was chosen for additional model testing to assess a hypothetical real-time model application. Total flow-volume errors ranged from 30.2 percent to -9.2 percent. Alternative methods of obtaining hydrologic data for model input are presented for use in the event that standard forms of hydrologic data are unavailable. (USGS)
W86-01968

ASSESSMENT OF WATER RESOURCES AT FORT CARSON MILITARY RESERVATION NEAR COLORADO SPRINGS, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
G. J. Leonard.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4270, 1984. 124 p, 21 fig, 18 tab, 32 ref.

Descriptors: *Surface water, *Groundwater, *Water quality, *Colorado, El Paso County, Fort Carson Military reservation, Arkansas River Valley, Front Range Urban Corridor, Water supply, Data collections.

The Fort Carson Military Reservation adjoins the rapidly growning Colorado Springs metropolitan area, where locally available water supplies are limited and strictly administered. Fort Carson purchases about 3,400 acre-feet of treated water annually from the city of Colorado Springs. The major streams entering Fort Carson have an estimated average annual discharge of 6,240 acre-feet of water per year upstream from diversions for municipal and domestic water supplies. The streamflow is unevenly distributed in time and consequently not dependable as a large or sole source of water. Ground water is available from alluvial and bedrock aquifers. Wells with yields greater than 100 gallons per minute can be expected from the alluvium along Rock and Little Fountain Creeks and from some parts of the Dakota-Purgatoire aquifer. The quality of surface water entering Fort Carson is generally suitable for irrigation and drinking but deteriorates eastward across Fort Carson. Water from the alluvial aquifer along Rock and Little Fountain Creeks in the eastern part of Fort Carson contains fluoride in concentrations exceeding drinking-water standards. Water from the Dakota-Purgatoire aquifer characteristically contains radiochemical constituents in concentrations that exceed drinking-water standards. (USGS)
W86-01969

SURFACE WATER RESOURCES OF SOUTH AFRICA; VOLUME I: DRAINAGE REGIONS A, B-THE LIMPOPO-OLIFANTS SYSTEM,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
B. J. Middleton, W. V. Pitman, D. C. Midgley, and R. M. Robertson.
Report No. 10/81; Part 2 (Appendices), March 1982. 331 p.

Descriptors: *Surface-groundwater relations, *Groundwater, *Data processing, Rivers, Limpopo River, Olifants River, South Africa, Data collections, Computer programs, Runoff, Reservoirs, Frequency analysis, Sediment yield, Rainfall, Streamflow, Evaporation, Meteorological data collection, Synthetic hydrology, Watersheds, Hydrology, Flow duration, Land use, Precipitation.

The appendices to Part 1 contain the following information on the Limpopo-Olifants system of South Africa: (A) hydrometeorological data (rainfall, streamflow, evaporation), (B) land use (irrigation, afforestation, reservoirs), (C) breakdown of tertiary catachments, (D) synthetic hydrology, (E) quaternary subcatchments, (F) storage requirements (flow duration-frequency plots, hydrological zones, evaporation loss, sediment yield), and (G) users guide to computer programs. (Cassar-PTT)
W86-01990

SURFACE WATER RESOURCES OF SOUTH AFRICA; VOLUME IV: DRAINAGE REGIONS E, G, H, J, K, L - THE WESTERN CAPE,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
W. V. Pitman, D. J. Potgieter, B. J. Middleton, and D. C. Midgley.
Report No 13/81: Part 2(Appendices), May 1982. 521 p.

Descriptors: *Hydrologic data, *Surface waters, Surface-groundwater relations, *Groundwater, *Data processing, Rivers, *South Africa, Data collections, Computer programs, Runoff, Reservoirs, Frequency analysis, Sediment yield, Rainfall, Streamflow, Evaporation, Meteorological data collection, Synthetic hydrology, Watersheds, Hydrology, Flow duration, Land use, Precipitation.

The appendixes to Part 1 contain the following information on the Western Cape region of South Africa: (A) hydrometeorological data (rainfall, streamflow, evaporation), (B) land use (irrigation, afforestation, reservoirs), (C) breakdown of tertiary catchments, (D) synthetic hydrology, (E) quaternary subcatchments, (F) storage requirements (flow duration-frequency plots, hydrological zones, evaporation loss, sediment yield), and (G) users guide to computer programs. (Cassar-PTT)
W86-01997

MAGNITUDE AND FREQUENCY OF FLOOD VOLUMES FOR URBAN WATERSHEDS IN LEON COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Franklin.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4233, 1984. 20 p, 2 fig, 5 tab, 32 ref.

Descriptors: *Regression analysis, *Flood recurrence interval, *Rainfall-runoff, *Unit hydrograph, Data collections, *Leon County, *Florida.

Techniques are provided for estimating runoff magnitudes for urban-flow streams in Leon County, Florida, for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years. Synthetic runoff volumes were generated by using a calibrated lumped-parameter rainfall-runoff model, pan evaporation data from Milton, Florida, and long-term unit rainfall records from Thomasville-Coolidge, Georgia, and Pensacola, Florida. The synthetic runoff volumes were used to develop station runoff-frequency relations which were used in multiple linear regression analyses to derive regional equations relating runoff to basin characteristics. The significant basin characteristic was impervious area. The average standard error of regression was + or - 16 percent for all recurrence intervals except the 2-year, + or - 18 percent and the 500-year + or - 17 percent. (USGS)
W86-02354

FLOODS OF APRIL 18, 1983 ON ST. THOMAS AND ST. JOHN, U.S. VIRGIN ISLANDS,
Geological Survey, San Juan, PR. Water Resources Div.
R. E. Curtis.
Available from OFSS, USGS, Box 25425 Lake-

wood, CO 80225. USGS Water-Resources Investigations Report 84-4184, 1984. 12 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Flood flow, Flood frequency, Peak flow, Flood profiles, Excess rainfall, Flood damage, *U.S. Virgin Islands, *St. Thomas, *St. John.

The U.S. Virgin Islands of St. Thomas and St. John experienced the most intense rainfall event in recorded history on April 18, 1983. Rainfall intensities of 2.5 inches per hour, and more than 16 inches in 18 hours were recorded. Almost instantaneous runoff caused widespread flood near the coastlines of both islands. Parts of Charlotte Amalie in St. Thomas were inundated with 4 feet or more of mud and flood water. Harry S. Truman Airport was flooded for 2 days with 2 to 3 feet of ponded water. On St. John, rural areas near Guinea Gut, Fish Bay, and Coral Bay were flooded. (USGS)
W86-02362

GEOLOGIC AND HYDROLOGIC DATA COLLECTED DURING 1976-1984 AT THE SHEFFIELD LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE AND ADJACENT AREAS, SHEFFIELE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
J. B. Foster, G. Garklavs, and G. W. Mackey.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 83-926, 1984. 261 p, 2 fig, 9 tab, 7 ref.

Descriptors: *Groundwater, *Geology, *Glacial soils, *Radioactive wastes, Waste disposal sites, *Illinois, Bureau County, Sheffield, Water quality.

Hydrogeologic studies were conducted at the low-level radioactive-waste disposal site near Sheffield, Illinois, from 1976-1984. Data in this report include water levels in wells, lake stages, inorganic, organic, and radiometric chemical analyses of ground and surface water, hydraulic conductivities of glacial materials, grain-size distribution, clay and carbonate mineralogy, and cation exchange capacities of the glacial materials. Also included are results of petrographic analyses, physical measurements of wells, stratigraphy and lithology of cores collected from test wells, and horizontal coordinates of wells. (USGS)
W86-02372

HYDROLOGY OF PRAIRIE DOG CREEK VALLEY, NORTON DAM TO STATE LINE, NORTH-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
L. E. Stullken.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4162, 1985. 49 p, 11 fig, 2 tab, 17 ref.

Descriptors: Hydrology, Steady-state model, Groundwater flow, Recharge, Discharge, Base flow, *Hydrogeology, Surface-groundwater relationships, Model studies, *Prairie Dog Creek Valley, *Kansas.

Development of water resources has been a major factor in the economy of Prairie Dog Creek valley in north-central Kansas. Releases from Norton reservoir to the Almena Irrigation District averaged 6,900 acre-feet per year during 1967-76. The number of irrigation wells increased from 4 to 147 during 1947-78. Ground water in the valley is derived mostly from the alluvial aquifer. The effects of irrigation on the aquifer are indicated by water-level changes. The water in storage increased from 130,000 to 136,000 acre-feet during 1947-78 due to recharge from surface-water irrigation. A steady-state model of the aquifer prior to irrigation (1947) indicated that most recharge was from precipitation (88 percent) and most discharge was to streams (54 percent) and evapotranspiration (26 percent). Although aquifer storage increased in this area, storage generally decreased in other areas of western Kansas. (USGS)
W86-02377

PHASE I SUMMARY AND PHASE II PLAN FOR COMPARING REGULATED WITH UNREGULATED STREAMFLOW IN THE YAKIMA RIVER AT UNION GAP, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02378

GAZATTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--MERRIMACK RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02381

TIME OF TRAVEL, WATER QUALITY, AND BED-MATERIAL QUALITY FOR THE CUYAHOGA RIVER WITHIN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02389

APPLICATION OF THE U.S. GEOLOGICAL SURVEY'S PRECIPITATION-RUNOFF MODELING SYSTEM TO THE PRAIRIE DOG CREEK BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02390

SELECTED HYDROLOGIC DATA FOR THE SOUTH PLATTE RIVER THROUGH DENVER, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02391

SURFACE-WATER INFLOW TO PUGET SOUND, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02395

CALIBRATION PROCEDURE FOR A DAILY FLOW MODEL OF SMALL WATERSHEDS WITH SNOWMELT RUNOFF IN THE GREEN RIVER COAL REGION OF COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02403

WATER RESOURCES OF THE COTTONWOOD WASH WATERSHED, UTE MOUNTAIN, UTE INDIAN RESERVATION, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
A. L. Geldon.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4027, 1985. 56 p, 13 fig, 10 tab, 48 ref.

Descriptors: Watersheds, Intermittent streams, *Alluvial aquifers, *Springs, *Water supply, *Water quality, Hydrologic budget, *Groundwater-surface water relations, *Colorado, Montezuma County, *Four Corners area, Ute Mountain, Ute Indian Reservation, Towaoc, Cottonwood Wash, Sleeping Ute Mountain.

Cottonwood Wash, near Towaoc, Colorado, is a 16-square-mile watershed with an estimated average annual precipitation influx of 14,600 acre- Most of this water is consumed by evapotrans tion. Except for snowmelt in the spring mo and infrequent rain storms, all flow in the wa from springs issuing from talus, block rubble, vium, colluvium, and Mancos Shale. Flow is g est during the spring months when the groun saturated from snowmelt and least during the e fall when many springs cease flowing. Most o water in the wash upstream from Towaoc i verted to Cottonwood Reservoir. Springs in wash downstream from Towaoc are distribut Most of the water from these springs, howe seeps back into the alluvium. One of these spr supplies about 19 acre-feet of water per yea Towaoc. The cumulative flow from 17 springs diffuse seepage was about 290 acre-feet in the water year. The quantity of recoverable wate the younger of two pediment deposits is a 2,000 to 4,000 acre-feet, depending on seasonal yearly variations in precipitation. Estimated un flow from the wash in the 1982 water year was acre-feet; estimated recharge to bedrock was acre-feet. Water from block rubble and talu suitable for most purposes; water from Mar Shale and alluvium may contain concentration dissolved solids that are unacceptable for dome use. (USGS)
W86-02404

STREAM DISCHARGE IN MICHIGAN--M CELLANEOUS MEASUREMENTS,
Geological Survey, Lansing, MI. Water Resour Div.
For primary bibliographic entry see Field 7C.
W86-02409

STATISTICAL MODELS FOR ESTIMATI FLOW CHARACTERISTICS OF MICHIG STREAMS,
Geological Survey, Lansing, MI. Water Resour Div.
D. J. Holtschlag, and H. M. Croskey.
Available from OFSS, USGS, Box 25425, La wood, CO 80225. USGS Water-Resources Inve gations Report 84-4207, 1984. 80 p, 8 fig, 15 tab, ref.

Descriptors: *Regression analysis, *Estimat equations, *Flow characteristics, River basins, H drometeorology, Average flow, Low flow, Du tion curves, Peak discharge, Regional analy *Michigan, *Statistical models.

Multiple-regression equations provide statisti models to estimate flow characteristics at ungag sites in Michigan. The equations require determi tion of several readily measureable basin and m tereological characteristics and an areal adjustm factor. Flow characteristics for which estimati equations have been prepared include mean a mean monthly flow, flow-duration, low flow, pe discharge, and flood volume. The precision of flow estimate varies with the flow characterist being estimated and the basin characteristics ha the lowest standard errors, whereas peak flow a low flow characteristics have the highest standa errors. Sites that have basin characteristics simi to the basin characteristics used to develop regression equations can be estimated more p cisely. Confidence limits can be computed abo the estimates using information included in t report. Need for additional gaging stations is sumed to be proportional to the standard error residuals found among five regions designated Michigan. Additional continuous-record statio may be most beneficial in region 3 for reducing t standard error of mean and mean monthly flo equations. Additional partial-record stations m be useful in region 4 for reducing the standa error of low flow and peak flow estimates. (USG
W86-02411

GAZETTEER OF HYDROLOGIC CHARA TERISTICS OF STREAMS IN MASSACH SETTS--HUDSON RIVER BASIN,
Geological Survey, Boston, MA. Water Resourc Div.
For primary bibliographic entry see Field 7C.
W86-02416

PRAGMATIC APPROACH TO EVALUATING A MULTIPURPOSE STREAM-GAGING NETWORK,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02417

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--COASTAL RIVER BASINS OF THE NORTH SHORE,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02418

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--CONNECTICUT RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02419

2F. Groundwater

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, MAY 1985,
Geological Survey, Tampa, FL. Water Resources Div.
. L. Barr.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-482, 1985. 1 p, 2 fig, 2 ref.

Descriptors: *Potentiometric level, Potentiometric flow, Hydrology, Hydrogeology, *Florida, *Maps.

A May 1985 potentiometric surface map of the Upper Floridan aquifer in west-central Florida depicts the annual low water-level period. Most areas of west-central Florida were experiencing drought conditions and water levels were at or approaching near-record low levels. Water levels in most wells measured in May 1985 were lower than in September 1985. May levels averaged about 5 feet lower than September levels in areas north of latitude 28 degrees 07' and about 13 feet lower in southern areas. Generally, water levels in May 1985 averaged about 4 feet lower than May 1984 levels in the north and about 6 feet lower in the south. (USGS)
W86-01920

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
. H. Langer, W. R. Moyle, L. R. Woolfender, and D. A. Mulvihill.
Available from OFSS, USGS BOX 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-B, 1983. 6 p, 3 fig, 40 ref.

Descriptors: *Groundwater levels, *Springs, Hydrogeology, *Groundwater data, Basin and Range Province, *California.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic properties of the southern California part of the Basin and Range province. The first map, at a scale of 1:500,000, shows the approximate altitude of the water table, and the location, temperature, and flow of large springs. The altitude of the water table is shown by contours where sufficient data exists; otherwise it is shown by data points. Springs with flows of 10 gallons per minute or more have been mapped. A second map at a scale of 1:1,000,000 shows the depth to ground water and areas of basin fill or consolidated rocks. In areas where the depth to ground water is less than 500 feet, the depth is shown by lines of equal depth to water or data points where data are insufficient to draw lines. Areas are shaded where the depth to the water table is generally greater than 500 feet. (USGS)
W86-01921

GEOHYDROLOGY OF VOLCANIC TUFF PENETRATED BY TEST WELL UE-25BNO1, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
R. G. Lahoud, D. H. Lobmeyer, and M. S. Whitfield.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4253, 1984. 44 p, 25 fig, 5 tab, 24 ref.

Descriptors: *Nevada, *Radioactive waste disposal, *Water levels, Hydrogeology, *Hydrologic properties, Igneous rocks, *Yucca Mountain, Nevada Test Site.

Test well UE-25bNo1, located on the east side of Yucca Mountain in the southwestern part of the Nevada Test Site, was drilled to a total depth of 1,220 meters and hydraulically tested as part of a program to evaluate the suitability of Yucca Mountain as a nuclear-waste repository. The well penetrated almost 46 meters of alluvium and 1,174 meters of Tertiary volcanic tuffs. The composite hydraulic head for aquifers penetrated by the well was 728.9 meters above sea level (471.4 meters below land surface) with a slight decrease in loss of hydraulic head with depth. Average hydraulic conductivities for stratigraphic units determined from pumping tests, borehole-flow surveys, and packer-injection tests ranged from less than 0.001 meter per day for the Tram Member of the Crater Flat Tuff to 1.1 meters per day for the Bullfrog Member of the Crater Flat Tuff. The small values represented matrix permeability of unfractured rock; the large values probably resulted from fracture permeability. Chemical analyses indicated that the water is a soft sodium bicarbonate type, slightly alkaline, with large concentrations of dissolved silica and sulfate. Uncorrected carbon-14 age dates of the water were 14,100 and 13,400 years. (USGS)
W86-01923

COMPUTER MODEL OF ONE-DIMENSIONAL EQUILIBRIUM CONTROLLED SORPTION PROCESSES,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-01925

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1984,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-01926

HYDROGEOLOGY AND EFFECTS OF TAILINGS BASINS ON HYDROLOGY OF SANDS PLAIN, MARQUETTE COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
N. G. Grannemann.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4114, 1984. 98 p, 31 fig, 21 tab, 32 ref.

Descriptors: *Hydrogeology, Groundwater recharge, Groundwater movement, Groundwater runoff, *Surface water - groundwater relationships, Obstruction to flow, Hydraulic conductivity, Leakage, Computer models, Marquette Iron Range, Marquette County, *Michigan.

A hydrogeological study of Sands Plain, a sandy outwash area in the north-central part of Michigan's Upper Peninsula, was conducted during 1979-82. Parts of the area are being considered as possible sites for construction and operation of iron mining tailings basins. Gribben Basin, an existing tailings basin in the western part of Sands Plains, covers 2.5 square miles; hypothetical tailings basins may cover as much as 11 square miles. Glacial deposits are the area's principal aquifer. The general direction of ground-water flow is from the outwash area toward Lake Superior. Before reaching Lake Superior, however, most ground water is discharged in a series of nearly parallel streams. Ground water accounts for 95 percent of the discharge of these streams. Precipitation collected at two sites had average pH values of 4.0. Dissolved solids concentrations in water from wells ranged from 41 to 246 milligrams per liter; in water from streams, they ranged from 82 to 143 milligrams per liter. Calcium and bicarbonate were the principal dissolved ions. A two-dimensional digital model of ground-water flow was used to simulate ground-water levels and runoff. The predictive computer simulations indicate that construction and operation of Gribben tailings basin, located in the western part of the study area, decreased ground-water flow to Goose Lake Outlet by 0.9 to 1.6 cubic feet per second. Construction and operation of four hypothetical tailings basins covering a total of 11 square miles is estimated to reduce ground-water flow to the area's streams by 7 to 18 cubic feet per second depending on the hydraulic properties of material comprising the basin boundaries. Leakage from all of the basins is estimated to range from 0.7 to 7 cubic feet per second. (USGS)
W86-01927

WATER RESOURCES AND EFFECTS OF DEVELOPMENT IN HERNANDO COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-01931

GROUND-WATER HYDROLOGY OF VOLUSIA COUNTY, FLORIDA, WITH EMPHASIS ON OCCURRENCE AND MOVEMENT OF BRACKISH WATER,
Geological Survey, Orlando, FL. Water Resources Div.
A. T. Rutledge.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4206, 1985. 84 p, 42 fig, 6 tab, 19 ref.

Descriptors: Brackish water, *Saltwater intrusion, *Drawdown, *Freshwater-saltwater interface, *Saline water intrusion, Path of pollutants, *Florida, Volusia County.

Brackish water is present in the eastern and western fringes of Volusia County, Florida in the surficial aquifer and in the Floridan aquifer system. Average pumpage in 1980 in Volusia County was 66 million gallons per day. Water levels in the Floridan aquifer system declined more than 10 feet over an area of 70 square miles from 1955 to 1982. The annual water budget of the budget of the Floridan aquifer system consists of 5 inches downward leakage inflow, 1 inch upward leakage outflow, 1 inch horizontal inflow, 1.5 inches horizontal outflow, 2.5 inches discharge from springs and flowing wells, and 1 inch pumpage. Saltwater intrusion is occurring in the surficial aquifer on the barrier island. There is little evidence that intrusion is occurring uniformly over large areas in the Floridan aquifer system. Vertical intrusion is occurring at sites of public-supply pumping. Many of these wells in the fringes of the county have been abandoned and replaced by wells closer to the central part of the county. Minimizing well depth is probably the single most effective step against intrusion. (USGS)
W86-01932

USE OF DOUBLE-MASS CURVES TO DETERMINE DRAWDOWN IN A LONG-TERM AQUIFER TEST IN NORTH-CENTRAL VOLUSIA COUNTY, FLORIDA,
Geological Survey, Orlando, FL. Water Resources

Div.
A. T. Rutledge.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4309, 1985. 29 p, 17 fig, 1 tab, 10 ref.

Descriptors: Drawdown, Aquifer test, Capture, Double-mass curve, Leakage, *Groundwater levels, Water yield, *Florida, Volusia County.

A test well withdrew water from the upper Floridan aquifer system at an average of 530 gallons per minute from June 1978 to July 1979. Ground-water levels were monitored in wells open to the upper Floridan (artesian) aquifer system and in wells open to the surficial (water-table) aquifer. Double-mass curves were used to separate drawdown from natural water-level fluctuations. Drawdowns in the Floridan were 4.3 feet at a site 350 feet away from the pumped well, 4.1 feet at a site 1,000 feet away, 1.0 foot at a site 1.0 mile away, and 0.4 foot at a site 5.8 miles away. After an initial drawdown of 0.2 foot at a surficial aquifer well 1,000 feet from the pumped well, there was some recovery, and long-term drawdown averaged less than 0.2 foot. In a five-day aquifer test during a period of no rainfall in 1976, the ratio of surficial aquifer drawdown to Floridan aquifer system drawdown reached equilibrum at 0.05. The results of the long-term test indicate that this ratio is the upper limit of long-term drawdown because of capture of evapotranspiration and runoff during the long-term test. (USGS)
W86-01933

WIRELINE-ROTARY AIR CORING OF THE BANDELIER TUFF, LOS ALAMOS, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-01934

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-01938

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFF AND LAHARIC BRECCIA, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-01939

OCCURRENCE OF SALINE WATER IN THE ALLUVIAL AQUIFER IN THE BOEUF-TENSAS BASIN, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-01940

NITROGEN, SULFATE, CHLORIDE, AND MANGANESE IN GROUND WATER IN THE ALLUVIAL DEPOSITS OF THE SOUTH PLATTE RIVER VALLEY NEAR GREELEY, WELD COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-01941

POTENTIOMETRIC MAP OF THE PALEOZOIC AQUIFER IN NORTHEASTERN MISSISSIPPI, NOVEMBER AND DECEMBER 1982,
Geological Survey, Jackson, MS. Water Resources Div.
D. Darden.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4254, 1984. 1 sheet, 3 fig, 6 ref.

Descriptors: *Potentiometric map, *Water level, Groundwater, Aquifers, Hydrogeology, *Mississippi, Paleozoic rock.

The Paleozoic rocks that outcrop in Tishomingo County, Mississippi, supply water to public, industrial, and domestic wells in two counties in the northeastern part of the State. Paleozoic rocks in the area consist mostly of beds of sandstone, shale, and limestone which dip about 30 feet per mile to the southwest. The potentiometric surface of the Paleozoic aquifer slopes generally to the west away from the area of outcrop and is strongly affected by large groundwater withdrawals at Corinth. The water level at Corinth has declined about 160 feet from 1954 to 1974 and recovered about 45 feet by 1982. Wells that were near the center of the cone of depression have been replaced by new wells located away from the center. (USGS)
W86-01942

POTENTIOMETRIC SURFACE MAP OF THE ALLUVIAL AQUIFER, EASTERN ARKANSAS, SPRING 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
J. Edds, and D. J. Fitzpatrick.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4264, 1984. 1 sheet, 5 fig, 7 ref.

Descriptors: Potentiometric level, *Water level, Hydraulic gradient, *Arkansas, *Missippi River alluvial aquifer, *Arkansas County, *Poinsett County.

The Mississippi River Alluvial Aquifer is a major source of water supply for irrigation in much of eastern Arkansas. Hydrologic maps of the potentiometric surface, water-level changes and depths to water in the aquifer, based on Spring 1983 measurements, are presented. The Mississippi River Alluvial Aquifer is comprised of Quaternary alluvial flood-plain and terrace deposits. The aquifer generally is partially-confined. Recharge to the aquifer is principally through precipitation and surface-water bodies. The potentiometric surface map indicates two cones of depression occurring in the aquifer beneath Arkansas, Poinsett, and Cross Counties as a result of heavy pumpage within these areas. A comparison of water-level data from 1982 and 1983 shows water levels in the aquifer generally decreasing in the area within the cones of depression. Water levels generally increased in the remainder of the area south and west of the White River, and along the Mississippi River. A map showing the depth to water below land surface indicates that water levels are generally shallowest near the Mississippi River and the Fall Line and deepest within the cone of depression. (USGS)
W86-01943

POTENTIOMETRIC SURFACE MAP OF THE SPARTA SAND AND MEMPHIS SAND AQUIFERS IN EASTERN AND SOUTH-CENTRAL ARKANSAS, SPRING 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
J. Edds, and D. J. Fitzpatrick.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4265, 1984. 1 sheet, 3 fig, 5 ref.

Descriptors: *Potentiometric level, *Groundwater levels, Groundwater, Water levels, *Arkansas, *Sparta Sand aquifer, *Memphis Sand aquifer.

The Sparta Sand and the Memphis Sand aquifers are a major source of industrial and public water supply and a minor but locally significant source of water for agricultural purposes in eastern and south-central Arkansas. The potentiometric surface map for this aquifer, compiled from water-level measurements made during the spring of 1983, indicates a generally southward potentiometric gradient. The potentiometric surface also illustrates the existence of three major cones of depression; one centered in Columbia County, one in Union County, and one in Jefferson County. Within the cones of depression, the majority of water
drawn is utilized for industrial and public su
The water-level change map for the Sparta
and the Memphis aquifer for the period bet
the springs of 1982 and 1983 shows overall a r
water levels across the study area, includin
cones of depression in Jefferson and Union C
ties; however, water levels within the cone de
sion in Columbia County generally decl
(USGS)
W86-01944

MAP SHOWING OUTCROPS OF TH DOMINANTLY ARGILLACEOUS SEDIM TARY AND METASEDIMENTARY RO BASIN AND RANGE PROVINCE, ARIZ
Geological Survey, Lakewood, CO. Water
sources Div.
For primary bibliographic entry see Field 8E.
W86-01945

MAP SHOWING OUTCROPS OF GRAN ROCKS, BASIN AND RANGE PROVINCE, ZONA,
Geological Survey, Lakewood, CO. Water
sources Div.
For primary bibliographic entry see Field 8E.
W86-01946

MAP SHOWING OUTCROPS OF PRE-Q TERNARY BASALTIC ROCKS, BASIN RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water
sources Div.
For primary bibliographic entry see Field 8E.
W86-01947

MAP SHOWING OUTCROPS OF TH DOMINANTLY AGRILLACEOUS SEDIM TARY AND METASEDIMENTARY RO BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water
sources Div.
For primary bibliographic entry see Field 8E.
W86-01948

GROUND-WATER DATA FOR MICHIGA 1983,
Geological Survey, Lansing, MI. Water Resou
Div.
G. C. Huffman.
Available from OFSS, USGS Box 25425 L
wood, CO 80225. USGS Open-File Report 84-
1984. 47 p, 5 fig, 2 tab, 100 ref.

Descriptors: *Water resources, *Groundwa
*Groundwater hydrographs, Water levels, W
use, Water quality, *Michigan.

Water levels, locations, depths, and aquifers tap
are given for 115 observation wells in Michig
Tabulated data include extremes of water levels
1983 and for the period of record, pumpage
most major ground-water users in the state
quality data on selected wells. The largest repor
user of ground water, the city of Lansing, pum
8.1 billion gallons from the Saginaw Format
and glacial deposits. (USGS)
W86-01950

OCCURRRENCE OF BEDS OF LOW HYDRA LIC CONDUCTIVITY IN SURFICIAL DEPO ITS OF FLORIDA,
Geological Survey, Tallahassee, FL. Water
sources Div.
H. G. Healy, and J. D. Hunn.
Available from OFSS, USGS Box 25425. US
Water-Resources Investigations Report 84-42
1984. 1 p, 1 fig, 1 tab, 59 ref.

Descriptors: Permeability coefficient, *Hydrolo
maps, Infiltration, Percolation, *Groundwat
*Geohydrology, *Florida.

The disposal of municipal and industrial wastes
or at shallow depths below land surface can res
in contamination of ground water--the source

drinking water for more than 90 percent of Florida's residents. This threat to public health has resulted in new State groundwater regulations. Knowledge of the ability of surficial deposits to retard movement of contaminants is important to the implementation of these regulations. This map report shows areas where beds of at least 10 feet thickness with a hydraulic conductivity (saturation) of less than 0.1 foot per day occur within 50 feet below land surface, based mainly on interpretations of lithology. The map is intended as a guide for making preliminary assessments and should not be considered definitive of permeability beneath a specific site. Available determinations of hydraulic conductivities of surficial deposits in Florida are shown in table format. (USGS)
W86-01951

HYDROGEOLOGIC DATA FROM PARTS OF THE DENVER BASIN, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
T. J. Major, S. G. Robson, J. C. Romero, and S. Zawistowski.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-274, 1983. 425 p, 7 fig, 13 tab, 111 ref.

Descriptors: *Aquifers, *Groundwater, *Hydrogeologic data, Surface water, Water quality, *Colorado, *Denver basin.

This report presents hydrogeologic data collected and compiled during 1956-81 as part of a comprehensive hydrogeologic data collected and compiled during 1956-81 as part of a comprehensive hydrogeologic investigation of the Denver basin, Colorado, by the U.S. Geological Survey in cooperation with the Colorado Department of Natural Resources, Division of Water Resources, Office of the State Engineer. The data, in tabular and graph- form, consist of records for 870 wells which include water-level data for 158 wells and water-quality analyses for 561 wells; geophysical logs from three wells which include resistivity, self potential, and natural gamma logs; and gain-and-loss data of streamflow measured at 54 sites. (USGS)
W86-01952

GROUND-WATER-QUALITY MONITORING NETWORK DESIGN FOR THE SAN JOAQUIN VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-01953

GROUND-WATER RESOURCES OF LANFAIR AND FENNER VALLEYS AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
A. Freiwald.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4082, 1984, 78 p, 4 fig, 4 tab, 10 ref.

Descriptors: Wells, Springs, *Water Quality, Well logs, Geology, Hydrology, Well yield, Precipitation, *Groundwater, Surface water, Water supply, Water yield, *California, Fenner, Lanfair, San Bernardino County.

Lanfair and Fenner Valleys and vicinity cover about 1,300 square miles in eastern San Bernardino County, California. Average annual precipitation ranges from 3 to 10 inches over the area. Ground water is utilized primarily for stock and domestic purposes, and occurs in the unconsolidated deposits as well as in the highly fractured consolidated rock. Ground-water levels in wells range from 5 to 0 feet below land surface, and well yields range from 3 to 1,200 gallons per minute throughout the study area. Records indicate that water levels are at or near their predevelopment levels. Springs occur along faults and formational contacts and generally discharge less than 5 gallons per minute. Measured ground-water outflow from Lanfair Valley at Piute Spring ranged from 100 to 630 acre-feet per year. Most of the water is of good quality for domestic and stock use. However, water from two wells indicates a concentration of sulfate that is above the recommended limit for drinking water. Water supplies are adequate for present needs. However, large-scale pumping would result in the lowering of the water table and a reduction of the ground water in storage. (USGS)
W86-01955

IRRIGATION DATA FROM CHASE, DUNDY, AND PERKINS COUNTIES, NEBRASKA,
Geological Survey, Lakewood, CO. Water Resources Div.
D. M. Stephen, F. J. Heimes, and R. R. Luckey.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-471, 1984. 31 p, 2 fig, 12 tabs, 5 ref.

Descriptors: *Pumpage, Ground-water irrigation, *Discharge measurement, High Plains, *Nebraska, Chase, Dundy, Perkins, Clampitron, Irrigation water, Water supply, Data collections, Hydrologic data.

This report summarizes data collected by the U.S. Geological Survey in Chase, Dundy, and Perkins Counties, southwest Nebraska. It includes data collected from 52 randomly selected wells that were monitored during the 1983 irrigation season to obtain measurements of discharge and the rate of energy consumption. The data were collected as part of a study to better define the relationship between pumpage and return flow from applied water. (USGS)
W86-01957

JANUARY 1984 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst, and B. J. Dague.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-613, 1984. 163 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Groundwater, Water-level changes, *Hydrologic data, *Kansas, Data collections.

Water-level measurements were made, mostly during January 1984, in about 1,450 wells in western and south-central Kansas. The measurements were made in mid-winter when pumping was minimal and water levels had recovered, for the most part, from the effects of pumping during the previous irrigation season. Annual hydrologic data are provided for relating water-level changes from a 'base-reference year' (predevelopment year), a year of abnormally high rainfall and minimum pumpage (1966 or 1974), and each of 7 consecutive years of measurement (1978-84). The 'base-reference year' is designated as 1940 for the southwestern area, 1944 for the south-central area, and 1950 for the northwestern and west-central areas. Water levels for the 'base-reference year' are established by measurements made during that year and by interpretation of maps showing water-level altitudes. Data also are provided for relating the average annual water-level changes, saturated thicknesses of the deposits, and percentage changes in saturated thicknesses.
W86-01960

AVAILABILITY AND CHEMISTRY OF GROUND WATER ON THE BRUNEAU PLATEAU, SOUTH-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. L. Moffatt, and M. L. Jones.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4065, 1984. 88 p, 15 fig, 7 tab, 31 ref.

Descriptors: Available groundwater, Available water, *Ground-water availability, *Groundwater irrigation, Available irrigation water, Bruneau plateau, *Idaho, *Groundwater chemistry.

The Bruneau plateau in south-central Idaho consists of about 889,600 acres of potentially irrigable land. About 112,200 of these acres have been developed for agriculture; 11,200 acres are irrigated with ground water, and the remaining acreage is irrigated with water from the Snake and Bruneau rivers and Salmon Falls Creek. On the basis of present usage, about 158,000 acre-feet of water per year are needed to develop an additional 63,000 acres. About 438,000 acre-feet per year are needed to irrigate existing and newly developed lands in dry years when streamflow in the Snake River at Milner Dam is inadequate to meet appropriated needs. Pumping lifts of about 400-600 feet and low well yields on the Bruneau plateau probably preclude large-scale irrigation development solely from local ground-water resources. However, supplemental sources of irrigation water are available from a perched-water aquifer, a thermal aquifer, and the regional aquifer adjacent to the plateau. About 100,000-115,000 acre-feet per year of water probably could be withdrawn from the perched and regional aquifers and conveyed to the plateau without serious impact on local ground-water resources. The amount of water that could be safely withdrawn from the thermal aquifer was not determined. (USGS)
W86-01963

GROUND-WATER LEVEL DATA AND PRELIMINARY POTENTIOMETRIC-SURFACE MAPS, YUCCA MOUNTAIN AND VICINITY, NYE COUNTY, NEVADA.
Geological Survey, Lakewood, CO. Water Resources Div.
J. H. Robison.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4197, 1984. 20 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Ground-water level, *Potentiometric level, Hydrologic maps, *Nevada, Nye County, Yucca Mountain, Hydrologic data.

The report contains a table of ground-water level data and two preliminary potentiometric-surface maps for the Yucca Mountain area. The water-level surface shown on the maps generally represents water-table (unconfined) conditions. The water table in the Yucca Mountain area occurs in ash-flow and air-fall tuffs of tertiary age. West of the crest of Yucca Mountain, water-level altitudes are about 775 meters above sea level. Along the eastern edge and southern end of Yucca Mountain, the potentiometic surface generally is nearly flat, is about 728 to 730 meters above sea level, and has a southeastward slope. (USGS)
W86-01964

ASSESSMENT OF WATER RESOURCES AT FORT CARSON MILITARY RESERVATION NEAR COLORADO SPRINGS, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-01969

GEOCHEMICAL PROCESSES IN THE GASCOYNE LIGNITE MINING AREA, BOWMAN COUNTY, NORTH DAKOTA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-01970

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. H. Langer, D. A. Mulvihill, and T. W. Anderson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-B, 1984. 7 p, 3 fig, 41 ref.

Descriptors: *Groundwater levels, *Springs, Aquifers, Maps, *Basin and Range province, *Arizona.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic properties of the Arizona part of the Basin and Range province. The first map, at a scale of 1:500,000, shows the approximate altitude of the ground-water table, and the location, temperature, and flow of large springs. The altitude of the ground-water table is shown by contours where sufficient data exists; otherwise it is shown by data points. Springs with flows of 10 gallons per minute or more have been mapped. A second map at a scale of 1:1,000,000 shows the depth to ground water and areas of basin fill or consolidated rocks. In areas where the depth to ground water is less than 500 feet, the depth is shown by lines of equal depth to ground water or data points where data are insufficient to draw lines. Areas are shaded where the depth to the ground water table is generally greater than 500 feet. (USGS)
W86-01971

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE PROVINCE,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-01972

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND PRE-QUATERNARY ASH-FLOW TUFFS, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-01973

MAP SHOWING OUTCROPS OF PRE-QUATERNARY BASALTIC ROCKS, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-01974

SURFACE WATER RESOURCES OF SOUTH AFRICA; VOLUME I: DRAINAGE REGIONS A, B-THE LIMPOPO-OLIFANTS SYSTEM,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
For primary bibliographic entry see Field 2E.
W86-01990

SURFACE WATER RESOURCES OF SOUTH AFRICA; VOLUME IV: DRAINAGE REGIONS E, G, H, J, K, L - THE WESTERN CAPE,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
For primary bibliographic entry see Field 2E.
W86-01997

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN GROUNDWATER MODELING: SELECTION, TESTING AND USE,
Michigan Dept. of Natural Resources, Lansing.
D. A. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-143214, Price codes: A08 in paper copy, A01 in microfiche. Volume 2: Appendices, September 1982. 174 p.

Descriptors: *Groundwater management, *Models, *Aquifers, *Groundwater movement, *Groundwater pollution, Model studies, Path of pollutants, Fate of pollutants, Landfills, Hydrologic models, Finite element method, Mathematical models.

This volume is comprised of four appendices. The first describes an assessment of the two-dimensional flow model at the Southwest Ottawa County Landfill. The two-dimensional methodology used at the site should be applicable to similar sites. The second appendix describes an investigation of contaminant transport parameters in Michigan Aquifers. The third appendix discusses aquifer dispersivities from field data with examples of contaminant transport in Michigan aquifers. The fourth appendix deals with a groundwater management strategy for Michigan using finite-element modelling of contaminant transport. The strategy uses the finite element groundwater/transport model GEOFLOW. The utility and accuracy of GEOFLOW is demonstrated by comparison with an analytical solution and by modeling an idealized flow situation. Further refinement of GEOFLOW would be achieved by delineating a more localized flow region effecting a smaller grid and accompanying Peclet number. (Geiger-PTT)
W86-02034

RELATIONSHIP OF LABORATORY AND FIELD DETERMINED HYDRAULIC CONDUCTIVITY IN COMPACTED CLAY SOILS,
Agricultural Research Service, University Park, PA. Northeast Watershed Research Center.
A. S. Rogowski, and E. B. Richie.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 520-533, 2 fig, 25 ref.

Descriptors: *Liners, *Clays, *Permeability coefficient, *Field tests, *Design criteria, *Soil mechanics, Fluid mechanics, Membranes, Soil types, Models, Infiltration, Infiltrometers, Hydrologic properties, Thermodynamics, Soil properties.

When soil is to be used as a liner material, accurate soil properties should be obtained by simple, rapid, and reliable methods across a grid or transect sampling area. Field measurements of soil hydrological properties are often time consuming and are being replaced by models of water retention (Brooks and Corey) and the Green and Ampt infiltration equation. The high variability of scale models may be bypassed by measuring hydrological properties at a larger scale. Another attractive approach for evaluating a potential performance of clay liners is the use of scaling theory based on the concepts of similar media. Scaling factors can be obtained from readily available infiltration parameters. In swelling systems, the effect of gravity on flow will be less or nonexistent, and vertical moisture profiles are likely to vary depending on clay thickness and location with respect to the water table. Fluid mechanics and thermodynamics have been used to predict the behavior of swelling soils. Soil structure, aggregate stability, and dispersion may also influence hydraulic conductivity. Hydraulic conductivity is generally evaluated at high gradients to shorten time needed to obtain results. The ring infiltrometer test for infiltration and measurements of macroporosity by the clothier and White infiltrometer are described along with design criteria for determining the hydrologic behavior of clay liners. (Geiger-PTT)
W86-02119

LOCATING THE GROUNDWATER POLLUTION SOURCES USING COMPUTER MODELS,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02121

SIMULATED EFFECTS OF AN ARTIFICIAL-RECHARGE EXPERIMENT NEAR PROCTOR, LOGAN COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02344

QUALITY OF GROUND WATER IN THE PRINCIPAL AQUIFERS OF NORTHEASTERN-NORTH CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02345

PRELIMINARY ANALYSIS OF GEOHYDROLOGIC DATA FROM TEST WELLS DRILLED NEAR CHESTER, ON KENT ISLAND, QUEEN ANNES COUNTY, MARYLAND,
Maryland Dept. of Natural Resources, Annapolis.
For primary bibliographic entry see Field 5A.
W86-02349

WATER RESOURCES OF THE RATTLESNAKE BUTTE AREA, A SITE OF POTENTIAL LIGNITE MINING IN WEST-CENTRAL, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
W. F. Horak.
Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4228, 1983. 53 p, 23 fig, 3 tab, 7 ref.

Descriptors: *Aquifers, *Groundwater, *Surface water, *Water chemistry, *Lignite, *Strip mining, Observation wells, Test holes, Belfield, Dickinson, South Heart, *North Dakota.

The D and E lignite beds, the two mineable beds in the lower Sentinel Butte Member (Fort Union Formation), underlies the entire Rattlesnake Butte study area, North Dakota but are unsaturated in much of their area of occurrence. Ground-water flow in both lignite aquifers is largely controlled by topography. Interconnected sand beds form aquifers between the E and D beds (E-D aquifer) and below the D bed (D-HT aquifer). These aquifers underlie the central part of the study area and consist of fine silty sand. Depth to the aquifers is as much as 320 feet. Aquifers also occur in sands of Late Cretaceous and early Tertiary age. Aquifers in the Fox Hills Sandstone (Cretaceous) and lower Tongue River Member (Tertiary) have depths of about 1,700 and 750 feet, respectively. All aquifers yield a sodium bicarbonate or sodium sulfate type water. Mean dissolved-solids concentrations in the four shallowest aquifers ranged from 1,290 to 1,970 milligrams per litter. North Creek and an unnamed tributary of Green River drain most of the study area. North Creek, the main drain, ceases to flow during several months of most years, while the Green River tributary, with a smaller basin area, has sustained base flows of 0.1 to 0.25 cubic foot per second. Mining-induced impacts on the shallow ground-water flow system would be very localized because of the already low water levels and the segmented nature of the flow system in the lignite aquifers. (USGS)
W86-02350

GROUND-WATER HYDROLOGY OF THE SEVIER DESERT, UTAH, WITH RESULTS OF DIGITAL-COMPUTER MODELING,
Geological Survey, Salt Lake City, UT. Water Resources Div.
W. F. Holmes.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. Issued as Utah Department of Natural Resources Technical Publication 79, and USGS Open-File Report 83-0432, 1984. 59 p, 31 fig, 2 tab, 36 ref.

Descriptors: Water resources, *Utah, Great Basin, *Hydrology, Recharge, Storage, Evapotranspiration, *Water quality, *Model studies, *Sevier Desert, *Finite-difference models, Model predictions.

Changes in ground-water withdrawals, water levels, and quality of water occurred in the artesian aquifers of the Sevier Desert, Utah during 1963-81. Ground-water withdrawals increased from an average of 9,500 acre-feet (11.7 cubic hectometers) per year between 1951 and 1963 to an average of 27,500 acre-feet (33.9 cubic hectometers) per year between 1964 and 1981. Most of the increased withdrawal was from the deep artesian aquifer. Water levels declined as much as 19 feet (5.8 meters) in the deep artesian aquifer and as much as 13 feet (4.0 meters) in the shallow artesian aqui

etween 1963 and 1981. The declines probably are e to increased ground-water withdrawals for igation and municipal use. Quality of water in rts of the shallow artesian aquifer is deteriorat-. The deterioration probably is the result of charge of poor quality from the overlying water-le aquifer. A digital-computer model was con-ucted to predict water-level changes resulting om changes in recharge and discharge for 20 ars (1981-2000) at one-half, one, and two times e 1977-79 average rate. The model computer ater-level declines of more than 80 feet (24 eters) in the deep artesian aquifer with withdraw-twice the 1977-79 average, declines of more an 40 feet (12 meters) if withdrawals were equal the 1977-79 average, and declines of more than feet (4.6 meters) if withdrawals were one-half e 1977-79 average. Computer water-level de-nes after 20 years in the shallow artesian aquifer ere more than 50 feet (15 meters) at two times e 1977-79 average rate, more than 15 feet (4.6 eters) at the 1977-79 average, and less than 4 feet 2 meters) at one-half the 1977-79 average. The odel also was used to predict the effects of proximate changes in ground-water withdrawals ated to the Intermountain Power Project. ater-level declines in the deep artesian aquifer of re than 15 feet (4.6 meters), and only small anges in water levels in the shallow artesian uifer after 20 years. These changes are in addi-n to changes computed for 20 years of with-awals at the 1977-79 rate. (USGS)
86-02351

ALUATION OF THE GROUND-WATER RE-URCES OF COASTAL GEORGIA: PRELIMI-RY REPORT ON THE DATA AVAILABLE OF JULY 1983,
ological Survey, Doraville, GA. Water Re-rces Div.
r primary bibliographic entry see Field 7C.
86-02352

ELIMINARY STUDY OF THE AQUIFERS THE LOWER MESILLA VALLEY IN XAS AND NEW MEXICO BY MODEL SIM-ATION,
ological Survey, Austin, TX. Water Resources
. Gates, D. E. White, and E. R. Leggat.
ailable from OFSS, USGS, Box 25425 Lake-od, CO 80225. USGS Water-Resources Investi-ions Report 84-4317, 1984. 21 p, 6 fig, 9 ref.

scriptors: *Groundwater, Groundwater basins, undwater movement, Model studies, Hydro-ic models, Transmissivity, Specific yield, Stor-, Well spacing, Aquifers, Aquifer characteris-, *Texas, El Paso, Juarez, Rio Grande, Ground-er modeling.

e aquifers in the lower Mesilla Valley of Texas New Mexico provide water for irrigation, strial use, and municipal supply. The shallow ifer principally is used for irrigation. The lium-depth aquifer and deep aquifer are used by city of El Paso for municipal supply, about ,000 acre-feet per year in 1975. The potential of the medium-depth and deep aquifers for gation, together with a planned increase in ping by the city, is causing concern about the act of this development. A three-dimensional tal model of the aquifers was developed to luate the responses of water levels to various emes of development, with particular emphasis he medium-depth and deep aquifers in and near Canutillo well field. The model simulations cate that if pumpage increases to 10,000 acre-per year from the medium-depth aquifer and 0,000 acre-feet per year from the deep aquifer, elsewhere is constant, then additional lowering vater levels would be as much as 24 feet in the lium-depth aquifer and as much as 52 feet in the aquifer. The water levels would decline ply during the first few months, after which levels would become nearly stable because the age between the aquifers probably is enough to nce the increased pumpage. The model also cated that lining of the channel of the Rio nde would result in an additional lowering of er levels by 10 feet in the medium-depth aqui-nd 8 feet in the deep aquifer. (USGS)
W86-02353

ILLINOIS GROUND-WATER OBSERVATION NETWORK - A PRELIMINARY PLANNING DOCUMENT,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02355

APPRAISAL OF THE SURFICIAL AQUIFERS IN THE POMME DE TERRE AND CHIPPEWA RIVER VALLEYS, WESTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
W. G. Soukup, D. C. Gillies, and C. F. Myette.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4086, 1984. 63 p, 26 fig, 15 tab, 37 ref.

Descriptors: *Outwash, *Aquifers, *Irrigation wells, *Streamflow depletion, Model studies, *Surface-groundwater relationships, *Minnesota, *Pomme de Terre River, *Chippewa River, Analytical model, Finite-difference models, Transient calibration.

The surficial outwash aquifer along the Pomme de Terre and Chippewa Rivers, Minnesota is as thick as 100 feet and has a maximum transmissivity of 35,000 feet squared per day. An analytical model of a 50-mile reach of the Pomme de Terre River valley indicates that the 43 existing irrigation wells pumping at maximum potential yields could reduce streamflow 77 cubic feet per second which exceeds low base flow of the river. Results from a finite-difference model of the Appleton area indicate that pumping lowered ground-water levels as much as 3 feet from 1973-80 and reduced streamflow 14 cubic feet per second. Simulation of increased irrigation pumping and decreased areal recharge during a three-year drought indicates that water levels may decline 9 feet and streamflow may be reduced 41 cubic feet per second. When results of the analytical and finite-difference models are combined, computed streamflow reductions exceed available base flow by as much as 60 cubic feet per second. Results from a finite-difference model of the Benson area indicate that at maximum hypothetical development, drought conditions and increased irrigation pumping may lower water levels 12 feet and reduce flow in the Chippewa River 30 cubic feet per second, which is less than low base flow. (USGS)
W86-02357

RECORDS OF SELECTED WELLS, ST. MARYS AND CALVERT COUNTIES, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02359

MASS WATER-LEVEL MEASUREMENTS OF FALL 1984 IN THE CENTRAL PLATTE RIVER BASIN, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02360

GROUND-WATER CONDITIONS AND WELL YIELDS IN FRACTURED ROCKS, SOUTHWESTERN NEVADA COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
R. W. Page, P. W. Anttila, K. L. Johnson, and M. J. Pierce.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4262, 1984. 38 p, 12 fig, 11 tab, 14 ref.

Descriptors: *Groundwater, *Well yield, Fractured rocks, Groundwater use, Saturated fracture zones, Recharge, Lineations, Groundwater discharge, Grass Valley, Nevada County, *California.

This report describes the availability of ground water in the southwestern part of Nevada County, and suggests general guidelines for selecting sites for future ground-water development in the study area. Ground water in this area occurs chiefly in fractures in hard pre-Tertiary metavolcanic and plutonic rocks generally above a depth of 215 feet. Some ground water is found at the contact between alluvium or decomposed granite and the underlying hard rock; little is found in alluvium or colluvium. Mean yield is less than 18 gallons per minute. (USGS)
W86-02364

CHEMICAL AND ISOTOPIC CHARACTERISTICS OF BRINES FROM THREE OIL- AND GAS-PRODUCING FORMATIONS IN EASTERN OHIO, WITH APPLICATIONS TO THE GEOCHEMICAL TRACING OF BRINE SOURCES,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02365

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE OF PROVINCE, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02366

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02367

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02368

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02369

HYDROGEOLOGY OF A LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
J. B. Foster, J. R. Erickson, and R. W. Healy.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4125, 1984, 83 p, 48 fig, 7 tab, 23 ref.

Descriptors: *Groundwater, *Glacial soils, *Radioactive wastes, *Tritium migration, Geology, Hydrology, Hydraulic conductivity, Groundwater flow model, Path of pollutants, *Illinois, Waste disposal sites, US Ecology Company, Inc., Sheffield facility.

The Sheffield low-level radioactive-waste facility is located on 20 acres of rolling terrain 3 miles southwest of Sheffield, Illinois. The shallow hydrogeologic system is composed of glacial sediments. Pennsylvania shale and mudstone bedrock isolate the regional aquifers below from the hydrogeologic system in the overlying glacial deposits. Pebbly sand underlies 67 percent of the site. Two ground-water flow paths were identified. The primary path conveys ground water from the site to the east through the pebbly-sand unit; a secondary path conveys ground water to the south and east

through less permeable material. The pebbly-sand unit provides an underdrain that eliminates the risk of water rising into the trenches. Digital computer model results indicate that the pebbly-sand unit controls ground-water movement. Tritium found migrating in ground water in the southeast corner of the site travels approximately 25 feet per year. A group of water samples from wells which contained the highest tritium concentrations had specific conductivities, alkalinities, hardness, and chloride, sulfate, calcium, and magnesium contents higher than normal for local shallow ground water. (USGS)
W86-02371

GROUND-WATER QUALITY DATA FOR THE ATLANTIC COASTAL PLAIN: NEW JERSEY, DELAWARE, MARYLAND, VIRGINIA, AND NORTH CAROLINA,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02374

GROUND-WATER DATA FOR GEORGIA, 1984,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02376

HYDROLOGY OF PRAIRIE DOG CREEK VALLEY, NORTON DAM TO STATE LINE, NORTH-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02377

HYDROLOGY OF AREA 60, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, NEW MEXICO, COLORADO, UTAH, AND ARIZONA,
Geological Survey, Albuquerque, NM. Water Resources Div.
F. E. Roybal.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-203, 1983. 80 p, 47 fig, 9 tab, 54 ref.

Descriptors: Coal mining, Surface water, Groundwater, *Water quality, *Geohydrology, Land use, Observation wells, Water level, Streamflow variability, Erosion, Sedimentation, *Water pollution sources, *New Mexico, *Colorado, *Utah, *Arizona, *Delores River basin, *San Juan River basin.

An expansion of coal-mining activity is planned for Coal Area 60, which is one of 20 hydrologic reporting areas in the Northern Great Plains and Rocky Mountain Coal Provinces. Coal Area 60 includes approximately 20,000 square miles and is located at the southern end of the Rocky Mountain Coal Province in northwestern New Mexico, southwestern Colorado, southeastern Utah, and northeastern Arizona. Area 60 includes parts of the Dolores and San Juan River basins. Water-quality characteristics are based on data from 67 surface-water stations and 49 ground-water stations. Dissolved-solids concentrations in perennial rivers such as the San Juan River commonly are less than 500 milligrams per liter. Dissolved-solids concentrations of 2,000 milligrams per liter or more are present in the flows of ephemeral channels such as the Chaco River. Calcium and bicarbonate ions are the predominant ions in headwater flows, whereas sodium and sulfate ions become increasingly more dominant in the downstream direction. Concentrations of dissolved iron, manganese, and other trace elements in surface water generally are less than the limits set in drinking-water and mining regulations; however, the total recoverable concentrations from water-sediment mixtures may exceed these limits. Suspended sediment concentrations exceeding 10,000 milligrams per liter are present in the flow of arroyos that drain areas with sparse vegetation. The chemical-quality characteristics of ground water are similar to those of surface water except that the dissolved-solids concentration in ground water from all formations, especially shale deposits, may exceed 3,000 milligrams per liter. Sulfate concentrations are small in the ground water associated with coal deposits. Large concentrations of fluoride are present in ground water from all formations; large concentrations of lead, selenium and nitrate are associated with certain formations. Large alkalinity concentrations are found in the surface waters and ground waters of Area 60. (USGS)
W86-02382

GEOLOGY OF THE SURFICIAL AQUIFER SYSTEM, BROWARD COUNTY, FLORIDA,
Geological Survey, Miami, FL. Water Resources Div.
C. R. Causaras.
Available from OFSS, USGS, Box 25425. Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4068. 1985. 2 pl, 9 fig, 9 ref.

Descriptors: *Geologic formations, *Cross sections, *Hydrology, Carbonate aquifers, Unconfined aquifer, *Forida, Broward County, *Biscayne aquifer.

The geologic framework of the surficial aquifer system, of which the Biscayne aquifer is the major component in Broward County, Florida, is presented in eight geologic cross sections. The cross sections are based on detailed lithologic logs of 27 test wells that were drilled, in the summer of 1981, through the sediments overlying the relatively impermeable units of the Hawthorn Formation, of Miocene age. The cross sections show the aquifer system as a wedge-shaped sequence of Cenozoic sediments. The aquifer thickness gradually decreases from more than 400 feet along the coast to about 160 feet in the west and southwest parts of Broward County. The sediments that comprise the aquifer system range in age from Pliocene to Pleistocene and are assigned to the following stratigraphic units from bottom to top: Tamiami Formation, Caloosahatchee Marl, Fort Thompson Formation, Key Largo Limestone, Anastasia Formation, Miami Oolite, and Pamlico Sand. (USGS)
W86-02383

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02384

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02385

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02386

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02387

DELINEATION AND DESCRIPTION OF A ZONE OF HIGHER SECONDARY PERMEABILITY IN THE SURFICIAL AQUIFER OF EASTERN PALM BEACH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
L. J. Swayze, and W. L. Miller.
Available from OFSS, USGS, Box 25425, D
wood, CO 80225. USGS Water-Resources Inv
gations Report 83-4249, 1984. 39 p, 22 fig, 5 ta
ref.

Descriptors: *Groundwater, Water quality, G
gy, *Florida, *Hydrogeology, Aquifers, *Pe
ability, Saline water intrusion, Palm Beach Co
Aquifer characteristics, *Secondary permeab

The surficial aquifer is the primary source of f
water for the heavily developed coastal are
eastern Palm Beach County, Florida. Well f
are generally located in a discontinuous zon
higher secondary permeability, the northern
extension of the Biscayne aquifer in the sur
aquifer, that extends from the Juno Beach
south to Broward County and varies in width
about 4 to 15 miles. The zone was formed
varying dissolution of aquifer limestone mate
during Pleistocene age changes in sea level,
ranges in depth from about sea level to 220
below sea level. Because of proximity to the A
tic Ocean and saltwater estuaries, the aquife
susceptible to saltwater intrusion. Ground wat
the west of the zone of higher secondary pe
ability is of poor quality. The ground wate
calcium bicarbonate dominant. Dissolved so
calcium carbonate hardness, and chloride
greatest along the saltwater intruded coastline
in the western part of the study area where dil
residual seawater exists. Total organic carbon
creases inland due to infiltration of rainw
through thicker layers of organic soils. Grou
water levels in the surficial aquifer in eastern P
Beach County are strongly influenced by
trolled levels in canals. In March 1981, afte
months of below average rainfall, ground-w
levels ranged from about 2 feet above sea l
along the coast to nearly 21 feet above sea leve
miles inland in the northwest section of the st
area. (USGS)
W86-02393

**ALDICARB-PESTICIDE CONTAMINATI
OF GROUND WATER IN EASTERN SUFFO
COUNTY, LONG ISLAND, NEW YORK,**
Geological Survey, Syosset, NY. Water Resou
Div.
For primary bibliographic entry see Field 5B.
W86-02394

**GEOHYDROLOGIC RECONNAISSANCE
THE AVOCA LIGNITE DEPOSIT AREA NE
WILLISTON, NORTHWESTERN NOR
DAKOTA,**
Geological Survey, Bismarck, ND. Water
sources Div.
W. F. Horak, and O. A. Crosby.
Available from OFSS, USGS, Box 25425, La
wood, CO 80225. USGS Water-Resources Inve
gations Report 85-4024, 1985. 22 p, 6 fig, 2 tab,
ref.

Descriptors: Aquifers, Groundwater, Surf
water, *Lignite, *Strip mines, Williston, *No
Dakota, Williams County.

The Avoca deposit in the Sentinel Butte mem
of Fort Union Formation consists of four potent
ly strippable lignite beds. Average bed thickness
in descending order, are 5, 5, 9, and 8 feet. In
area between Stony Creek and Crazy Man Coul
the lignite beds are unsaturated, and betwe
Stony Creek and Little Muddy River, only the t
lowest beds are saturated. Aquifers in sandsto
beds in the Fox Hills Sandstone and the Hell Cre
Formation probably would yield as much as
gallons per minute of sodium bicarbonate ty
water. However, the aquifers are from 1,100
1,800 feet below land surface. Individual sand be
in the Tongue River and Sentinel Butte Membe
of the Fort Union Formation are the shallow
aquifers below the minable lignite beds. Prope
constructed wells completed in these sand be
could yield as much as 40 gallons per minute. T
water generally is a sodium bicarbonate type w
dissolved-solids concentrations ranging from abo
500 to 4,200 milligrams per liter. (USGS)
W86-02398

REGIONAL AQUIFER-SYSTEM ANALYSIS OF THE NORTHERN GREAT PLAINS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING--GEOCHEMICAL EVOLUTION OF GROUND-WATER COMPOSITION IN TWO CONFINED AQUIFER SYSTEMS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02400

MATHEMATICAL MODEL OF THE TESUQUE AQUIFER SYSTEM NEAR POJOAQUE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
G. A. Hearne.
Available from Distribution Br., USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2205, 1985. 75 p, 81 fig, 17 tab, 55 ref.

Descriptors: *Mathematical models, *Groundwater movement, *New Mexico, Water levels, Withdrawal, Irrigation, Water use, Model studies, Simulation analysis.

A three-dimensional digital model of ground-water flow was constructed to represent the dipping anisotropic beds of the Tesuque aquifer system underlying the Pojoaque River basin and vicinity, New Mexico. Simulations of steady-state conditions and historical ground-water withdrawals were consistent with observed data. The model was used to simulate the response of the aquifer system to an irrigation-development plan in the Pojoaque River basin. Storage is the main source of water; 34.05 cubic feet per second (86 percent of the withdrawal rate) was simulated to be withdrawn from storage after 50 years of withdrawals for irrigation development. The maximum simulated water-level decline was 334 feet, and the net simulated streamflow capture from the Rio Grande and the Santa Cruz, Pojoaque, and Santa Fe Rivers was 5.63 cubic feet per second (14 percent of the withdrawal rate). The sensitivity of the model was tested by varying aquifer characteristics to the limits of the plausible range. Change in hydraulic head in the Pojoaque River basin is most sensitive to hydraulic conductivity. In all simulations, after 50 years of withdrawals, the maximum simulated decline in hydraulic head ranged between 210 and 374 feet, storage in the aquifer system was the source of 80 to 90 percent of the water withdrawn from wells, and streamflow capture from the Rio Grande and its tributaries plus irrigation diversions from the tributaries of the Pojoaque River simulated a decrease in the flow of the Rio Grande of between 17.13 and 21.11 cubic feet per second. (USGS)
W86-02402

WATER RESOURCES OF THE COTTONWOOD WASH WATERSHED, UTE MOUNTAIN, UTE INDIAN RESERVATION, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02404

SUMMARY OF RESULTS OF AN INVESTIGATION TO DEFINE THE GEOHYDROLOGY AND SIMULATE THE EFFECTS OF LARGE GROUNDWATER WITHDRAWALS ON THE MISSISSIPPI RIVER ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02405

HYDROLOGY OF PRAIRIE DOG CREEK VALLEY, NORTON DAM TO STATE LINE, NORTH-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02406

EVALUATION OF MAJOR DIKE-IMPOUNDED GROUND-WATER RESERVOIRS, ISLAND OF OAHU, WITH A SECTION ON FLOW HYDRAULICS IN DIKE TUNNELS IN HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02407

PROGRESS REPORT ON BLACK MESA MONITORING PROGRAM-1984,
Geological Survey, Flagstaff, AZ. Water Resources Div.
G. W. Hill.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-483, 1985. 24 p, 4 fig, 9 tab, 6 ref.

Descriptors: *Groundwater, *Water level, Water quality, *Aquifers, *Arizona, Black Mesa, *Navajo Indian Reservation, *Hopi Indian Reservation, Monitoring.

The N aquifer is an important source of water in the 5,400 square-mile Black Mesa area on the Navajo and Hopi Indian Reservations. The project is designed to monitor long-term effects on the ground-water resources of the mesa as a result of withdrawals from the aquifer by a strip-mining operation. Withdrawals from the N aquifer by the mine have increased from 95 acre-ft in 1968 to more than 4,000 acre-ft in 1984. Water levels in the confined area of the aquifer have declined as much as 75 feet in some municipal and observation wells within about a 15-mile radius of the mine well field. Part of the drawdown in municipal wells is due to local pumpage. Water levels have not declined in wells tapping the unconfined area of the aquifer. Chemical analysis indicate no significant changes in the quality of water from wells that tap the N aquifer or from springs that discharge from several stratigraphic units, including the N aquifer, since pumping began at the mine. (USGS)
W86-02408

HYDROLOGY OF YUCCA MOUNTAIN AND VICINITY, NEVADA-CALIFORNIA--INVESTIGATIVE RESULTS THROUGH MID-1983,
Geological Survey, Lakewood, CO. Water Resources Div.
R. K. Waddell, J. H. Robison, and R. K. Blankennagel.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4267, 1984. 72 p, 13 fig, 10 tab, 68 ref.

Descriptors: Groundwater, Surface water, *Radioactive waste disposal, *Hydrogeology, *Groundwater movement, Path of pollutants, *Nevada, *California, Nevada test site.

Yucca Mountain, Nevada, is one of several sites under consideration for construction of the first repository for high-level nuclear waste. The climate is arid; few perennial streams are present in the region. Flash floods occasionally occur. The site is underlain by at least 1,800 meters of volcanic tuffs of Tertiary age; limestones and dolomites of Paleozoic age underlie much of the surrounding region, and, together with alluvial deposits, comprise the major aquifers. Yucca Mountain is in the Alkali Flat-Furnace Creek Ranch ground-water subbasin, which is part of the Death Valley ground-water basin. Discharge occurs at Alkali Flat almost entirely by evapotranspiration, and at Furnace Creek Ranch from small springs and seeps. Beneath Yucca Mountain, depth to water ranges from about 460 to 700 meters; the rock under consideration for construction of the repository is in the unsaturated zone. Rate of recharge at Yucca Mountain is small, perhaps much less than 5 millimeters per year. Within the saturated zone, water movement is principally along fractures. The hydraulic gradient is small east (downgradient) of Yucca Mountain, and increases to the north and west. Lack of effective-porosity data presently precludes accurate calculation of flow velocity and travel times. (USGS)
W86-02413

GEOLOGY, HYDROLOGY, AND WATER QUALITY OF THE CAMBRIAN AND ORDOVICIAN SYSTEMS IN NORTHERN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
A. P. Visocky, M. G. Sherrill, and K. Cartwright.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. Illinois State Water Survey, Illinois State Geological Survey, Cooperative Groundwater Report 10, 1985. 136 p, 45 fig, 6 tab, 123 ref.

Descriptors: *Geologic formations, *Groundwater, *Aquifers, *Confining beds, *Aquifer systems, Bedrock, Pumping, Drawdown, Water Quality, Hydrology, Geology, *Hydrogeology, Cambrian system, Ordovician system, *Illinois, Confined area, Unconfined area.

Cambrian and Ordovician strata provide much of the groundwater supply for approximately 250 municipalities and 150 industries in the northern half of Illinois. The Cambrian and Ordovician aquifers average approximately 1,000 feet in thickness, and are hydraulically interconnected and behave as a single aquifer. Recharge occurs principally by vertical percolation of precipitation in areas where the aquifers are not confined. Additional recharge in heavily pumped areas occurs through leakage across the overlying Maquoketa Confining Unit. The practical sustained yield of the Cambrian and Ordovician aquifers is estimated to be 65 million gallons per day in northeastern Illinois. Pumpage has exceeded this amount since about 1958. The largest withdrawals occur in Cook, DuPage, Kane and Will Counties. Withdrawals have caused water levels to decline as much as 900 feet in parts of these counties. In north-central and northwestern Illinois, development has not exceeded the pratical sustained yield. Groundwater in the recharge area of the Cambrian and Ordovician aquifers is chemically homogeneous and low in dissolved solids. However, significant vertical and areal changes in the chemical character of groundwater occur in the confined area. As water moves away from the recharge area to the east and south, it increases in dissolved solids. (USGS)
W86-02414

2G. Water In Soils

PREDICTING LEACHATE GENERATION IN LANDFILLS: A NEW METHOD,
Anderson (James C.) Associates, Camden, NJ.
For primary bibliographic entry see Field 5E.
W86-02122

FIELD VARIABILITY OF SOIL PHYSICAL PROPERTIES,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
A. J. Peck.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 189-221, 7 fig, 1 tab, 90 ref.

Descriptors: *Soil water, *Soil physical properties, *Variability, *Irrigation, *Solute transport, Spatial analysis, Scaling theory, Steady flow, Nonsteady flow, Sampling, Correlation analysis, Mathematical studies, Kriging, Flow, Leaching, Infiltration, Soil porosity, Drainage, Wetting.

Quantitative studies of soil variability and its impact on water and solute transport in fields are in a state of rapid development. However, several implications are apparent. A very large number of samples are needed to reasonably estimate the mean of properties with high spatial variability, such as water and solute drainage rate. Present methods for spatial analysis, which provides a means for characterizing soil variability are limited. A major problem of methods for computing the spatial scale of soil variation is the dependence of the correlogram on the length of a transect through its effect on the variance of sample data. It

is preferable to use the variogram to quantify scales of soil variation. The scaling of soil water properties provides a single parameter for describing soil variations to nonuniform soil imply that evapotranspiration and drainage are almost uniform in areas which do not lose or gain water by surface runoff. A definition of scaling factors through infiltration and drainage experiments is easier and as effective as working from soil water retention and conductivity relationships. Soil variability is a major factor contributing to nonuniform leaching of salts from fields. When the probability density function of solute transport properties has a large variance, a relatively large spatial variation in water application rates appears to have little influence on field-averaged solute concentrations during leaching. At present, an equivalent uniform medium cannot be defined to describe water and solute transport in nonuniform fields using the Richards equation. (Cassar-PTT)
W86-02129

2H. Lakes

SOURCE MOVEMENT AND EFFECTS OF NITROGEN AND PHOSPHORUS IN THE HEADWATERS OF HOP BROOK, MARLBOROUGH, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02343

2I. Water In Plants

ADVANCES IN IRRIGATION,
For primary bibliographic entry see Field 3F.
W86-02123

IRRIGATION SCHEDULING BASED ON A DYNAMIC CROP RESPONSE MODEL,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 3F.
W86-02131

MODEL OF ROOT GROWTH AND WATER UPTAKE ACCOUNTING FOR PHOTOSYNTHESIS, RESPIRATION, TRANSPIRATION, AND SOIL HYDRAULICS,
Auburn Univ., AL. Dept. of Agronomy and Soils.
M. G. Huck, and D. Hillel.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 273-333, 17 fig, 2 tab, 37 ref, 3 append.

Descriptors: *Soil-water-plant relationships, *Irrigation, Model studies, *Root development, Evapotranspiration, Photosynthesis.

A model describing the growth and function of higher herbaceous plants considers several independent processes governed by a set of quantitative relationships involving the transport and transformations of water, carbon, and energy in the soil-plant-atmosphere continuum. This model, a simplification of reality, does not explicitly account for nutrient uptake, soil aeration, soil temperature, soil mechanical resistance to root penetration, or plant physiological processes (photosynthesis, respiration, stomatal closure, translocation, and allocation of assimilates). However, the model in its present state of development can predict plant responses to various sets of circumstances for comparison with observations. Possible uses for the model include root growth and distribution under different soil and climate conditions; assessment of the effects of irrigation strategies on crop response, evaporation, and drainage; and study of the role of genetic or adaptive factors involved in drought tolerance. (Cassar-PTT)
W86-02132

TECHNIQUES FOR ESTIMATING IRRIGATION WATER REQUIREMENTS,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
R. D. Burman, R. H. Cuenca, and A. Weiss.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 335-394, 13 fig, 16 tab, 56 ref.

Descriptors: *Evapotranspiration, *Irrigation, *Soil-water-plant relationships, Computers, Penman equation, Crop coefficients, Root zone, Effective precipitation, Climatic data.

Estimation of irrigation water requirements requires determination of evapotranspiration and other factors. Methods for estimating evapotranspiration are described. These include the grass- versus alfalfa-based reference crop method; the Penman method; non-Penman methods such as Priestly-Taylor, FAO-24, Jensen-Haise, Blaney-Criddle, U.S. Soil Conservation Service TR-21, and Boorenbos-Pruitt. Methods are also given for estimating other factors: crop coefficients, rooting depth, and effective rainfall. Methods for computing evapotranspiration must be calibrated for different climates. The suitability of 16 methods are compared, using lysimeters at 10 locations worldwide. No one method works well in all climates. Commonly, the methods under- or overpredicted evapotranspiration on the order of 100% for climates unlike those in which they had been developed. Data required for four FAO methods (Blaney-Criddle, radiation, Penman, and pan evaporation) are given. Use of microprocessors and data collection instruments improve the accuracy and speed of developing irrigation water requirements. A sample problem is calculated, applying the Penman equation to estimate reference crop evapotranspiration. (Cassar-PTT)
W86-02133

2J. Erosion and Sedimentation

SEDIMENT YIELDS IN EASTERN MONTANA: SUMMARY OF DATA AND PROPOSED TECHNIQUES FOR ESTIMATING SEDIMENT YIELDS FROM SMALL, UNGAGED WATERSHEDS,
Geological Survey, Helena, MT. Water Resources Div.
J. H. Lambing.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water Resources Investigations Report 84-4200, 1984. 45 p, 3 fig, 9 tab, 35 ref.

Descriptors: *Sediment yield, *Basin characteristics, *Multiple regression, Erosion, Ungaged watersheds, Streamflow, Sediment transport, *Eastern Montana, Fort Union coal region, Power River coal region.

Sediment-yield data for 121 sites in eastern Montana have been compiled from results of studies conducted by various Federal, State, and private agencies. Methods used to determine mean annual sediment yields included reservoir sedimentation surveys, suspended-sediment sampling in streams, and estimates of gross erosion and indirect estimation based on physical characteristics of the basin. Multiple-regression equations were developed and evaluated for their adequacy in estimating mean annual sediment yields from small, ungaged watersheds in eastern Montana. Sediment yields determined from reservoir surveys were used as the dependent variable because they were considered the most representative of long-term yields. Independent variables consisted of basin characteristics which could be measured from maps or obtained from published sources. Consequently, equations developed in this study do not require onsite data. Evaluation of equations indicated that the best prediction capability was obtained when reservoir basins were segregated into classes of similar vegetation/soil complex. The predictive capability of regression equations developed for each of three classes of vegetation/soil complex, as indicated by the coefficient of determination (R2), ranged from 0.59 to 0.96. Corresponding standard errors ranged from 95 to 20 percent. The equations are applicable for small drainage basins of 2 square miles or less within the study area. (USGS)
W86-01922

ANNUAL SUSPENDED-SEDIMENT LOAD THE GREEN RIVER AT GREEN RI UTAH, 1930-82,
Geological Survey, Salt Lake City, UT. Resources Div.
K. R. Thompson.
Available from OFSS, USGS, Box 25425 wood, CO 80225. USGS Water-Resources In gations Report 84-4169, 1984. 17 p, 7 fig, 1 ta ref.

Descriptors: Sedimentation, Sediment trans *Sediment discharge, *Sediment load, Sedi *Sedimentation rates, *Sediment yield, Sedim *Colorado River Basin, Green River Basin, *

The Green River above gaging station 09315 at Green River, Utah, drains about 44,850 sq miles in Utah, Colorado, and Wyoming. The age annual precipitation near the station was inches. Rocks ranging in age from Precambri Holocene are exposed in the Green River drai basin above Green River, Utah. Shale, silts and mudstone of Tertiary age probably are most easily eroded rocks in the basin, and contribute a large part of the sediment load i Green River. During 1930-82, the U.S. Geolo Survey collected records of fluvial sedimen station 093150000. Based on these records mean annual suspended-sediment load was a 15,630,000 tons, ranging from 1,780,000 during 1934 to 43,400,000 tons during 1937. minimum daily load of 54 tons was on Septe 27, 1956, and the maximum daily load of 2,230 tons was on July 11, 1936. Analysis of the susp ed-sediment records collected from 1930-82 a tion 093150000 indicated that the accuracy o records is fair prior to 1945 and good for remaining period of record. The records after reflect the use of improved sampling equipm (USGS)
W86-01935

ESTUARY AS A SEDIMENT TRAP: ALT NATE APPROACHES TO ESTIMATING FILTERING EFFICIENCY,
Delaware Univ., Newark. Coll. of Marine Stu
For primary bibliographic entry see Field 2L.
W86-02076

RECENT SEDIMENTATION RATES CHESAPEAKE BAY,
Dartmouth Coll., Hanover, NH. Dept. of E Sciences.
For primary bibliographic entry see Field 2L.
W86-02077

ROLE OF FLOCCULATION IN THE FILT ING OF PARTICULATE MATTER IN ES ARIES,
Bedford Inst. of Oceanography, Dartmouth (N Scotia).
For primary bibliographic entry see Field 2L.
W86-02078

ERODING SOILS: THE OFF-FARM IMPAC
Conservation Foundation, Washington, DC.
For primary bibliographic entry see Field
W86-02247

PROGRESS REPORT: PERFORMANCE THE VIBRATING U-TUBE FLUID DENSI GAGE FOR MEASURING SUSPENDED-SE MENT CONCENTRATION,
Geological Survey, Minneapolis, MN. Water sources Div.
For primary bibliographic entry see Field 7B.
W86-02348

DISTRIBUTION AND TRANSPORT OF TRA SUBSTANCES IN THE SCHUYLKILL RIV BASIN FROM BERNE TO PHILADELPH PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water sources Div.
For primary bibliographic entry see Field 5B.
W86-02410

HYDRAULIC AND SEDIMENT CHARACTERISTICS AT THE NORTH CHANNEL BRIDGE, JAMAICA BAY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
W. W. Staubitz, and S. W. Wolcott.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4085, 1985. 43 p, 6 fig, 11 tab, 23 ref.

Descriptors: Hydraulics, Tides, *Tidal currents, *Channel scour, Bottom sediments, Suspended sediments, Water quality, *New York, Jamaica Bay, North Channel Bridge, North Channel, Data collections.

Data were collected during the spring of 1984 in the vicinity of North Channel Bridge in Jamaica Bay, New York to define the hydraulic regime and the physical characteristics and chemical quality of bottom sediments. The data were used in a semi-quantitative analysis to predict the effects of bridge replacement and the attendant resuspension of bottom sediments, on the hydraulics and quality of water and bottom sediments. The bay-bottom configuration at the bridge site was defined, and continuous tidal stage and tidal velocity data were collected for about a month. In addition, eight bottom-sediment samples were collected near the bridge and analyzed. Results of the hydraulic analysis show that the proposed bridge should not have any measurable effect on the net water transport at the bridge cross section. The sediment data indicate that bottom sediments are relatively unpolluted in the vicinity of the bridge. Seventy-five percent of the resuspended bottom sediments will probably settle within 186 m of the bridge during an average ebb tide. Metals and nutrients released from the sediments to the water column are expected to be diluted far below detection limits. The extra oxygen demand exerted by the resuspended bottom sediments is also expected to be far less than ambient biochemical oxygen demand of the water column. (USGS)
W86-02412

APPROACH FOR APPRAISING THE ACCURACY OF SUSPENDED-SEDIMENT DATA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02415

2K. Chemical Processes

AVAILABILITY AND CHEMISTRY OF GROUND WATER ON THE BRUNEAU PLATEAU, SOUTH-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-01963

CRITICAL COMMENT ON THE INTERNATIONAL ATOMIC ENERGY AGENCY REPORT ON THE ADVISORY GROUP MEETING ON STABLE ISOTOPE REFERENCE SAMPLES FOR GEOCHEMICAL AND HYDROLOGICAL INVESTIGATIONS, VIENNA, AUSTRIA, SEPTEMBER 19-21, 1983, BY R. GONFIANTINI,
Geological Survey, Reston, VA. Water Resources Div.
T. B. Coplen, I. Friedman, and J. R. O'Neil.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4136, 1984. 6 p, 1 fig, 2 ref.

Descriptors: Geochemistry, Isotopes, Water quality standards, Oxygen isotopes.

According to U.S. Geological Survey records, a report prepared by R. Gonfiantini summarizing the findings and recommendations of the 1983 Advisory Group Meeting on Stable Isotope Reference Samples for Geochemical and Hydrologic Investigations held in Vienna does not accurately represent the consultants' consensus on three important points. The consultants (1) recommended no value for the C02-H20 oxygen isotope fractionation factor, not the cited value of 1.04115, (2) adopted a value of 1.0309 rather than 1.03086 to relate the PDB and SMOW scales, and (3) adopted a firm 180 value of -2.20% for NBS-19 on the PDB scale rather than agreeing that this would be a tentative value subject to modification when more measurements in selected laboratories are available. (USGS)
W86-01966

HYDROGEOLOGIC RECONNAISSANCE OF STRATIFIED-DRIFT AQUIFERS NEAR SIMSBURY, CONNECTICUT: AVAILABLE DATA AND FUTURE NEEDS,
Geological Survey, Hartford, CT. Water Resources Div.
J. W. Bingham.
Available from OFSS, USGS Box 24525 Lakewood, CO 80225. USGS Water-Resources Information Report 83-4145, 1984. 31 p, 4 fig, 24 ref.

Descriptors: *Glacial aquifers, *Ground-water availability, Ground-water potential, *Aquifer characteristics, Water-resources development, *Connecticut, *Town of Simsbury, Stratified-drift aquifers, Hartford County, Saturated thickness.

Hydrogeologic data from several sources were used to prepare maps showing the extent, saturated thickness, and composition of stratified-drift deposits near Simsbury, Connecticut. This synthesis of available data is intended to guide future ground-water studies by identifying favorable areas for development and additional information useful for resources planning and management. Deposits suitable for ground-water development underlie part of Stratton Brook valley and an area between the Farmington River and the community of Hoskins. Other potentially favorable areas occur east of the Farmington River near Avon, in the upper part of Stratton Brook valley and Bissel Brook valley. Extensive, thick deposits of silt, clay, and sand unsuitable for ground-water development underlie most of the Farmington River valley. In several areas of the town, subsurface data is sparse and the water-yielding characteristics of the stratified drift are unknown. (USGS)
W86-01967

RESEARCH PROGRAM FOR ATMOSPHERIC CHEMISTRY, RADIATION AND DYNAMICS,
Atmospheric and Environmental Research, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W86-01996

FATES OF URANIUM AND THORIUM DECAY SERIES, NUCLIDES IN THE ESTUARINE ENVIRONMENT,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2L.
W86-02079

WATER ANALYSIS, VOLUME 1: INORGANIC SPECIES, PART 1,
For primary bibliographic entry see Field 5A.
W86-02257

ORIGIN AND NATURE OF SELECTED INORGANIC CONSTITUENTS IN NATURAL WATERS,
University of Southern California, Los Angeles. Environmental Engineering Program.
B. A. Eichenberger, and K. Y. Chen.
IN: Water Analysis, Academic Press, Orlando, FL, 1982, Volume 1: Inorganic Species, Part 1. p 1-54, 1 tab, 255 ref.

Descriptors: *Water analysis, *Trace elements, *Trace metals, *Inorganic compounds, *Chemical reactions, Reviews, Metals, Hydrogen ion concentration, Conductance, Dissolved solids, Water quality, Drinking water, Natural waters, Metal complexes, Hydrolysis.

Inorganic species enter natural waters from a variety of sources such as the weathering of rocks and soils, atmospheric fallout, and anthropogenic inputs. The possible interactions occurring between metallic species and other solution species are described, followed by a discussion of individual metals. These interactions include: hydrolysis reactions, complexation with inorganic ligand, complexation with organic ligands, and conductance and pH effects. The pH and conductivity of the water system can control solubilization or agglomeration and therefore subsequent sedimentation of the metal species. A discussion of the possible hydrolysis products, complex species, and toxicity for 15 metals and three nonmetals in natural-water systems is given. Twelve of the metals under consideration are incorporated in the EPA Primary and Secondary Drinking Water Regulations (As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Se, Ag, and Zn). Sb, Be, and Ni, which have also shown toxic properties, are included in the discussion. B, F, and cyanides are the three nonmetals considered. (Geiger-PTT)
W86-02258

REDOX POTENTIAL: ITS MEASUREMENT AND IMPORTANCE IN WATER SYSTEMS,
Maryland Geological Survey, Baltimore.
O. P. Bricker.
IN: Water Analysis, Academic Press, Orlando, FL, 1982, Volume 1: Inorganic Species, Part 1. p 55-83, 11 fig, 2 tab, 101 ref.

Descriptors: *Oxidation-reduction potential, *Chemical reactions, *Water anlaysis, *Trace, elements, *Natural waters, Oxidation, Trace metals, Dissolved solids, Hydrogen ion concentration, Conductance, Potentiometers, Electrodes.

Oxidation and reduction (redox) reactions play an important role in determining the behavior of many elements in the environment. The theoretical framework of redox reactions is given. The redox potential is usually measured electrometrically with an electrode pair consisting of an inert metal electrode coupled with a reference electrode. The electrometers usually employed are the direct reading meter and the null balance meter. The electrodes of the electrometer must be made of a material that is inert to chemical reaction in the system being measured, but electroactive to both the reduced and oxidized species involved. The nobel metals, boron carbide, and graphite are commonly used in electrodes. The hydrogen electrode is the ultimate reference standard of redox potential measurements. The calomel electrode and the silver-silver chloride electrode are also described. The operation of reference electrodes depends upon liquid junction effects. The redox potential is a variable of major importance in characterizing systems containing elements that exhibit more than one oxidation state. When the appropriate thermodynamic data are available, the equilibrium configuration of a redox system may be easily modeled for a given set of conditions. Perhaps the most reliable method currently available for evaluating the redox state of a system is quantitative analysis of the oxidized and reduced species of a component of the system. (Geiger-PTT)
W86-02259

ALKALINITY AND ACIDITY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
J. R. Kramer.
IN: Water Analysis, Academic Press, Orlando, FL, 1982, Volume 1: Inorganic Species, Part 1. p 85-135, 7 fig, 5 tab, 20 ref.

Descriptors: *Alkalinity, *Acidity, *Water analysis, *Natural waters, *Chemistry properties, Trace elements, Hydrogen ion concentration, Physiochemical properties, Colloids, Chemical analysis, Chemical reactions.

Alkalinity is a routinely measured parameter for natural waters and wastewaters, whereas acidity is less commonly measured but is involved in analysis of low-pH solutions such as rainfall. Alkalinity and acidity are conservative terms that change only with the volume of the sample. Parameters that are

significant in alkalinity and acidity determinations consist of nutrients, trace metals, organic acids, gases, solids, and colloids. There is often a good relationship between specific conductance and the alkalinity for natural waters when calcium and bicarbonate ions make up the major portion of ions. The monoprotic, diprotic, and carbonate systems are considered along with Gran and modified Gran analysis of titration data, and analysis of mixed ligand systems. Some details of anlaysis of acidity and alkalinity are considered. Methods involving modified Gran analysis are encouraged although fixed-endpoint methods are briefly discussed, but particular attention is given to the use and determination of H-ion concentration rather than activity. The inability to obtain a linear function in a modified Gran analysis is often due to wrong assumptions regarding electrode response and also to the reliance on pH buffer solutions. (Geiger-PTT)
W86-02260

CONDUCTANCE: A COLLECTIVE MEASURE OF DISSOLVED IONS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 1B.
W86-02261

THEORY AND MEASUREMENT OF TURBIDITY AND RESIDUE,
Hach Co., Loveland, CO.
R. D. Vanous, P. E. Larson, and C. C. Hach.
IN: Water Analysis, Academic Press, Orlando, FL, 1982, Volume 1: Inorganic Species, Part 1. 1982, p 163-234, 37 fig, 6 tab, 15 ref.

Descriptors: *Turbidity, *Dissolved solids, *Suspended solids, *Physical properties, *Water analysis, Chemical properties, Wastewater analysis, Water quality, Natural waters, Nephelometers, Opacity, Light penetration.

Any natural water sample that the anslyst comes in contact with will invariably contain residue. The importance of monitoring residue was not fully realized and its applications were not widespread until the late 19th century. The nonspecific analytical techniques of residue analysis and turbidimetry are based largely on the physical parameter of size, with little or no significance attached to their chemical nature. The principles of light scattering that are fundamental to turbidity measurements are described, with special emphasis on Raleigh scattering and Mie scattering. The effects of sample and instrument parameters on turbidity measurement are examined. Early turbidimetric methods utilized the visual devices of Jackson, Hellige, Duboscq, and Parr. Modern nephelometric instruments rely on detectors such as the photomultiplier tube, vacuum photodiode, the silicon photodiode, and the CdS photoconductor. Responses of commercially available nephelometers that affect the outcome of turbidity measurements are compared. Process instruments used to continually monitor turbidity are described. A comparison of various specifications of nephelometric instruments is given. The calibration and standardization of nephelometric instruments are considered along with the potential of future nephelometric developments. The procedures used for the determination of residue (suspended and dissolved solids) are reviewed. (Geiger-PTT)
W86-02262

SALINITY SOURCES AND PROBLEMS OF THE DANUBE RIVER BASIN,
North Dakota State Univ., Fargo. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W86-02273

SOUTHWESTERN SALINITY SITUATION: THE ROCKIES TO THE MISSISSIPPI,
Army Engineer Div. Southwestern, Dallas, TX.
For primary bibliographic entry see Field 5B.
W86-02274

SALINITY BALANCE OF THE LOWER VIRGIN RIVER BASIN, NEVADA AND ARIZONA,
Montana Univ., Missoula. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W86-02277

GRAND VALLEY SALT PICK-UP CALCULATIONS,
Bureau of Reclamation, Grand Junction, CO.
For primary bibliographic entry see Field 5B.
W86-02278

CHEMICAL REACTIONS INFLUENCING SALINITY INCREASE OF SOIL AND GROUNDWATERS IN THE GREAT BASIN, WESTERN UNITED STATES,
Nevada Univ. System, Reno. Desert Research Inst.
B. Bohm, and R. L. Jacobson.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 525-535, 4 fig, 20 ref.

Descriptors: *Groundwater, *Salinity, *Water pollution sources, Calcium, Magnesium, Sodium, Potassium, Silica, Chloride, Alkalinity.

Groundwater chemistry in the semi-arid western Great Basin is mostly controlled by common processes of rock dissolution and formation of secondary minerals. The major cations and silica are provided from dissolution of silicate minerals. Levels of Ca, Mg, SO4 and alkalinity are mostly controlled by incongruent silicate reactions. Chloride is derived from traces in rocks and only minimally from cyclic salts. It increases gradually along a flow path and due to the high solubility of its salts, its levels are not restricted. The acidity required for the advance of rock dissolution is probably mostly provided by CO2 derived from geothermal processes, and to a lesser degree from biological activity in soils and perhaps locally from the oxidation of sulfide minerals. (Author)
W86-02311

QUALITY OF GROUND WATER IN THE PRINCIPAL AQUIFERS OF NORTHEASTERN-NORTH CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
J. C. Ebbert.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4102, 1984. 112 p, 24 fig, 37 tab, 20 ref.

Descriptors: *Water quality, *Groundwater, Water quality standards, *Washington.

In 1979 the quality of ground water in major aquifers in northeastern-north central Washington State was assessed in terms of inorganic-chemical, trace-metal, and fecal-coliform concentrations. For the Spokane Valley aquifer some organic-chemical data were also included. Results of this assessment indicate that the ground water in the region is generally suitable for most uses. (USGS)
W86-02345

ANALYSIS OF GROUND-WATER-QUALITY DATA IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02361

CHEMICAL AND ISOTOPIC CHARACTERISTICS OF BRINES FROM THREE OIL- AND GAS-PRODUCING FORMATIONS IN EASTERN OHIO, WITH APPLICATIONS TO THE GEOCHEMICAL TRACING OF BRINE SOURCES,
Geological Survey, Columbus, OH. Water Resources Div.
K. J. Breen, C. G. Angelo, R. W. Masters, and A. C. Sedam.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4314, 1985. 58 p, 14 fig, 1[illegible] 25 ref.

Descriptors: *Brines, *Chemical properties, wells, Isotope studies, *Geochemistry, A metals, Alkaline earth metals, Ions, Berea S stone, Clinton sandstone, Albion Knox Dolo Rose Run sandstone, *Ohio.

Chemical and isotopic characteristics of sel inorganic constituents are reported for brines the Berea Sandstone of Mississippian age, the ton sandstone, Albion Sandstone of Silurian and the Rose Run formation of Cambrian Ordovician age in 24 counties in eastern Ionic concentrations of dissolved constituen brines from these formations generally fall i following ranges (in millimoles per kilogra brine): Na, Cl > 1,000; 100 < Ca, Mg < 1,0 < K, Br, Sr, Li, Fe, SO4 < 100; Mn, Zn, A HCO3, SiO2 < 1. Mean ionic concentratio Ca, Mg, Na, Cl, K, SO4 and Br, and mean v of density and dissolved solids are signific different at the 95-percent confidence level in formation. Only potassium has a unique conce tion range in each formation. Selected conce tion ratios are identified as potential indicator geochemical tracing of brines having some hi of dilution. The k:Na ratios work best for ide ing the source formation of an unidentified b Isotopic characteristics of hydrogen and ox indicate a meteoric origin for the water matr the brines. Sulfur isotopes may have utility differentiating brines from oxidizing ground w (USGS)
W86-02365

GROUND-WATER QUALITY DATA FOR ATLANTIC COASTAL PLAIN: NEW JERS DELAWARE, MARYLAND, VIRGINIA, NORTH CAROLINA,
Geological Survey, Trenton, NJ. Water Resou Div.
L. L. Knobel.
Available from OFSS, USGS, Box 25425, L wood, CO 80225. USGS Open-File Report 85- 1985. 84 p, 1 fig, 10 tab, 8 ref, 1 pl.

Descriptors: *Coastal aquifers, Coastal pl *Data collections, Groundwater, Statistics, *W quality, *Groundwater data, *Atlantic Co Plain, Delaware, Maryland, New Jersey, N Carolina, Virginia.

This report is a compilation of chemical analyse ground-water samples in the Atlantic Coastal P from North Carolina through New Jersey. It tains records of 3,616 chemical analyses of gro water selected from more than 15,000 analyse WATSTORE. These analyses serve as the base for interpreting the geochemistry of northern Atlantic Coastal Plain aquifer syst Reported chemical data include common an and cations, selected trace metals, and selec physical characteristics. (USGS)
W86-02374

VOLATILE TRACE-ELEMENT CONCENTRATIONS IN SNOWMELT CONTRIBUTIONS STREAMS MONITORED BY HYDROLOG BENCH MARK NETWORK STATIONS IN T CONTERMINOUS UNITED STATES WHE AVERAGE ANNUAL SNOWFALL EXCEEDS INCHES,
Geological Survey, Bismarck, ND. Water sources Div.
For primary bibliographic entry see Field 5B.
W86-02397

GEOHYDROLOGIC RECONNAISSANCE THE AVOCA LIGNITE DEPOSIT AREA NE WILLISTON, NORTHWESTERN NOR DAKOTA,
Geological Survey, Bismarck, ND. Water sources Div.
For primary bibliographic entry see Field 2F.
W86-02398

REGIONAL AQUIFER-SYSTEM ANALYSIS THE NORTHERN GREAT PLAINS IN PAR

OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING--GEOCHEMICAL EVOLUTION OF GROUND-WATER COMPOSITION IN TWO CONFINED AQUIFER SYSTEMS,
Geological Survey, Lakewood, CO. Water Resources Div.
T. Henderson.
Available from Distribution Br, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Professional Paper 1402-C, 1984. 84 p, 53 fig, 32 tab, 122 ref.

Descriptors: *Groundwater, *Geochemistry, Mass transfer, Isotope studies, *Wyoming, *Montana, Major chemical elements, Minor chemical elements, *Kootenai Formation, *Fox Hills Sandstone, *Lance Formation.

The Kootenai Formation in the Judith Basin, Montana, and the Lance Formation and Fox Hills Sandstone in the Powder River Basin, Wyoming, constitute two important sandstone aquifer systems in the Northern Great Plains region. Calculation of the saturation states of aquifer minerals suggests several carbonate, silicate, and aluminosilicate phases, which could control ground-water chemistry. Mass transfer modeling indicates that the observed behavior of major and minor dissolved species in both systems can satisfactorily be explained by equilibration with calcite and dolomite. Specific processes controlling the geochemistry of these systems are probably the incongruent dissolution of dolomite to form calcite driven by the dissolution of CO2. Plausible CO2 sources include organic carbon oxidation and lignite coalification. Aluminosilicates influence major element chemistry primarily as substrates for cation exchange. Measured variations in dissolved carbonate isotopic composition compare favorably with carbon isotopic evolution, calculated by assuming de-dolomitization. Ground-water flow rates, calculated by adjusting measured carbon-14 activities for carbonate mass transfer, are comparable to values calculated from hydrologic aquifer tests and potentiometric data. These carbon-14 flow rates average .6 meters per year for the Second Cat Creek aquifer of the Kootenai Formation, and 1.3 meters per year for the Lance-Fox Hills aquifer. (USGS)
W86-02400

2L. Estuaries

APPEARANCE AND WATER QUALITY OF TURBIDITY PLUMES PRODUCED BY DREDGING IN TAMPA BAY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 6G.
W86-01929

METHODS FOR THE COLLECTION OF GEOCHEMICAL DATA FROM THE SEDIMENTS OF THE TIDAL POTOMAC RIVER AND ESTUARY, INCLUDING DATA FOR 1978-1980 AS AN APPENDIX,
Geological Survey, Reston, VA. Water Resources Div.
. D. Goodwin, B I. Schultz, D. L. Parkhurst, N. . Simon, and E. Callender.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-074, 1984. 129 p, 4 fig, 4 tab, 42 ref.

Descriptors: Rivers, *Estuaries, Sediments, Pore water, Alkalinity, Sulfide, Sulfate, Phosphate, Carbon, Ammonium, Silica, Iron, Manganese, Chloride, Sodium, Potassium, Calcium, Magnesium, Porosity, Nitrogen, Phosphorus, Cores, Tidal Potomac River, *Potomac Estuary, Sediment sampling, Core processing, *Geochemical data, Water quality, pH, Eh.

The chemical composition of bottom sediments and their associated pore waters from the tidal Potomac River and Estuary was studied from May 1978 through June 1980. Pore waters were routinely analyzed for pH, Eh, alkalinity, and concentrations of sulfide, sulfate, phosphate, carbon, ammonium, silica, iron, manganese, chloride, sodium, potassium, calcium, and magnesium. Porosity, weight loss on ignition, and carbon, nitrogen, and phosphorus contents were determined for the solid sediments. The range of salinity and chemical composition encountered in the estuary frequently necessitated modifications of standard methods of analysis. Therefore, the methods used, their modifications, and their limitations are presented in some detail. The appendix lists the data obtained from six sampling periods. (USGS)
W86-01930

ESTUARY AS A FILTER,
Proceedings of the Seventh Biennial International Estuarine Research Conference, Virginia Beach, Virginia, October 23-26, 1983. Academic Press, Orlando, FL. 1984. Edited by Victor S. Kennedy. 511 p.

Descriptors: *Estuaries, *Filtration, *Particulate matter, *Fate of pollutants, Sediments, Sedimentation, Water circulation, Management, Aquatic life.

Estuaries and coastal areas act as filters between rivers and oceans by trapping significant quantities of sediments and associated pollutants. This filter aspect is emphasized in a collection of papers concerning physical processes, geological processes, chemical-geochemical processes, biological processes, and management implications. The physical shape, mixing, circulation, characteristics, and stage of evolution of the estuary strongly influence its filtering capacity. The Chesapeake Bay and fjords such as Puget Sound are particularly effective filters for particulate matter. Chemical and geochemical processes are illustrated in case studies of nutrients and other substances in northern San Francisco Bay and in the Delaware Estuary. Biological processes involving surface foam, phytoplankton, aquatic plants, and bacteria are shown to affect nutrient and sediment transport in several estuaries. Management strategies are given for reduced freshwater inflow, sedimentation in the Mississippi Delta, pollution in the Chesapeake Bay, and the rehabilitation of water quality in the Thames Estuary. (Cassar-PTT)
W86-02070

ESTUARY AS A FILTER: AN INTRODUCTION,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, and V. S. Kennedy.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 1-11, 10 ref.

Descriptors: *Estuaries, *Filtration, *Particulate matter, *Sedimentation, Suspended sediments, Sediments, Water circulation, Mixing, Rivers, Saline water, Tidal effects, Wind waves, Dissolved solids, Turbidity, Colloids, Nutrients, Organic carbon, Productivity, Aquatic life, *Fate of pollutants, Geochemistry, Management, Sediment transport.

The filter action of estuaries modifies the suspended matter and chemical regime as well as physical inputs such as currents, wind, and tides. This action has both negative effects (dissolved oxygen depletion) and positive effects (rapid recycling of nutrients and organic matter). Estuary circulation ranges from the river-dominated, highly stratified type to the thoroughly mixed, sectionally homogeneous type. The most effective filtration, where productivity is highest, occurs near the upstream limit of sea salt penetration and near the estuary mouth. The turbidity maxima are usually in the null zone, where the upstream flow of the lower layer dissipates. Geochemical removal of dissolved and colloidal material is affected by mixing, gravitational circulation, and alternate deposition and resuspension of bottom sediment by tidal scour and wind waves. Biological and biochemical filtration is a result of filter-feeding activity and biological fixation of dissolved materials into particulate form. Submerged macrophytes remove both dissolved and suspended particulates from the water. An understanding of the filtering capacities of estuaries should be incorporated into management programs. (Cassar-PTT)
W86-02071

TURBULENCE AND MIXING IN ESTUARIES,
Liverpool Univ. (England). Dept. of Oceanography.
K. F. Bowden.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 15-26, 2 fig, 19 ref.

Descriptors: *Estuaries, *Water circulation, *Mixing, *Turbulence, Currents, Water currents, Filtration, Currents, Model studies, Advection, Diffusion, Dispersion, Tidal effects, Turbidity, Rivers, Sediment transport, Saline water.

Mixing and dispersion in an estuary result from a combination of advective and diffusive processes and are closely related to patterns of circulation. The intensity and scale of turbulence depend largely on the stability of the density distribution and so affect directly the vertical fluxes of momentum and matter. Indirectly, the state of turbulence also influences the longitudinal and transverse mixing. In setting up models to predict changes in estuarine conditions arising from natural external causes or human intervention, most attention in the past has been given to longitudinal fluxes across planes perpendicular to the axis of an estuary. The apparent simplicity of one-dimensional treatments, often used for this purpose, conceals the importance of contributions from physical processes in the vertical and transverse directions. It is likely that two- and three-dimensional models will be more widely used in the future, but their successful employment calls for a better understanding of the physical processes which are to be simulated. (Author)
W86-02072

VERTICAL VARIATIONS IN RESIDUAL CURRENT RESPONSE TO METEOROLOGICAL FORCING IN THE MID-CHESAPEAKE BAY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
D. W. Pritchard, and M. E. C. Vieira.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 27-65, 13 fig, 4 tab, 11 ref. 0CN8208363A01.

Descriptors: *Estuaries, *Filtration, *Water currents, *Wind pressure, Chesapeake Bay, Model studies, Currents, Tidal effects, Rivers, Atmospheric pressure.

Records of the nontidal current velocity obtained from current meters deployed for 20 days in two cross sections in Chesapeake Bay were used with an interpolation scheme to produce a vertical profile of the laterally-averaged longitudinal velocity component of one meter depth intervals at each section, at 3-hour intervals over the 15-day truncated record. Various statistical procedures were used to relate variations in the residual current, at each depth, to wind variations. Surface layers down to about 8 m responded directly to wind with little time lag. A slope of the water surface was also set up by the wind, with a consequent barotropic pressure force directly opposite to the wind. The current near the bottom responded first to this pressure force, flowing opposite to the wind with a phase lag of about 8 hours. This counter response proceeded up the water column, such that in the intermediate layers just below the pycnocline the negative response to the wind had a phase lag of about 20 hours. A diagnostic analytical model, based upon a Fourier transform of the linearized equations of motion, was exercised for a four-layered simulation of the vertical response of the currents to inputs of the observed fluctuations in wind and surface slope. The major features of the time variations in the residual currents in the four layers were reproduced by the model. (Author)
W86-02073

TRANSPORT VARIABILITY IN A FJORD,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
G. A. Cannon, D. E. Bretschneider, and J. R. Holbrook.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 67-78, 5 fig, 5 ref.

Descriptors: *Estuaries, *Filtration, *Fjords, *Water circulation, *Fate of pollutants, Bottom water, Mixing, Tidal effects, Dissolved solids, Suspended sediments, Particulate matter, Water circulation, *Puget Sound, *Washington, Saline water, Sediments, Rivers.

Bottom water in fjord-like Puget Sound is renewed several times a year, usually at the largest flood tides through Admiralty Inlet and at the smallest neap tides. The controlling mechanism appears to be tidal and mixing processes at the entrance sill. Although the average bottom water replacement time is about two weeks, complete renewal does not occur every two weeks. The inflowing bottom water entrains some of the seaward flowing upper water at the landward side of the sill. This acts as a filter to prevent some dissolved and particulate matter with their associated contaminants from leaving the system. (Cassar-PTT)
W86-02074

ESTUARY AS A FILTER FOR FINE-GRAINED SUSPENDED SEDIMENT,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, and H. H. Carter.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 81-105, 3 fig, 2 tab, 53 ref.

Descriptors: *Estuaries, *Filtration, *Particulate matter, *Sedimentation, Suspended sediments, Sediments, Mixing, Tidal effects, Currents, Water currents, Sediment transport, Model studies, Saline water, Fate of pollutants, Stratification, Chesapeake Bay, Rivers, Turbidity, Potomac River, Wind effects.

Estuaries function as filters for the signals they receive from the land and the sea. The nontidal residual circulation, tidal mixing, and estuarine geometry determine the efficiency of this filter for suspended sediment. Tidal currents provide energy for mixing saltwater from the ocean with freshwater from the river. The resulting salinity distribution drives that part of the nontidal circulation caused by density differences, which in turn influences the salinity patterns and resulting density gradients. This feedback between salinity redistribution and gravitational circulation places a constraint (filter) on the range of variations in flow and salt concentration in the estuary. The nontidal circulation also controls the distribution and transportation of suspended sediment, and the deposition of fine particles with the estuary. The distributions of salt and fine suspended matter control the behavior of many nonconservative constituents such as nutrients, radionuclides and some metals, their modes of occurrence and transport, and their reservoirs of accumulation. The result of these processes is that the estuary modifies significantly the strength and the form of the signals it receives from land and sea. Alteration of an estuary's gravitational circulation pattern by changing its freshwater input or its geometry modifies its filtering efficiency. In general, as an estuary changes from being highly stratified toward being well-mixed, its filtering efficiency for land-derived constituents first increases to a maximum (in the partially-mixed region) and then decreases. A simple kinematic model is used to demonstrate the relationship between estuarine type and filtering efficiency for Chesapeake Bay. (Author)
W86-02075

ESTUARY AS A SEDIMENT TRAP: ALTERNATE APPROACHES TO ESTIMATING ITS FILTERING EFFICIENCY,
Delaware Univ., Newark. Coll. of Marine Studies.
R. B. Biggs, and B. A. Howell.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 107-129, 2 fig, 4 tab, 61 ref. X-003256-01.

Descriptors: *Estuaries, *Filtration, *Sedimentation, *Particulate matter, Capacity/inflow ratio, Model studies, Aquatic life, Zooplankton, Oysters, Shellfish, Suspended sediments, Sediments, Delaware Bay, Bathymetry, Sediment cores, Sediment transport, Rivers, Saline water.

The sediment trapping efficiency of estuaries for particulate matter was reviewed using several methods of estimating trapping efficiency: box models, historical changes in bathymetric data, geochronological data, and the capacity-inflow ratio (C/I). Most open water estuaries (those which have not yet evolved into deltaic systems) showed 90-100% sediment trapping efficiency. The C/I was computed for several estuaries using the mean low water volume to minimize tidal variations and the precipitation times watershed area instead of actual inflow. An exponential curve was devised to use the C/I to predict the percent sediment trapped. A >99% sediment trapping efficiency was equivalent to a C/I of about 2, about 75% t 0.05 C/I, and 30% to 0.006 C/I. A conceptual model was developed to show the source and intensity of areal depositional processes. Biologically mediated sedimentation was shown to be a major factor in sedimentation. For example, the zooplankton, oysters, and mussels in Delaware Bay fix about 400 billion kg/year of sediment. This is 200 times the annual sediment input from the rivers (1.4 billion kg/year). (Cassar-PTT)
W86-02076

RECENT SEDIMENTATION RATES IN CHESAPEAKE BAY,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
C. B. Officer, D. R. Lynch, G. H. Setlock, and G. R. Helz.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p.131-157, 4 fig, 2 tab, 27 ref.

Descriptors: *Estuaries, *Sediment transport, *Filtration, *Sedimentation rates, *Chesapeake Bay, Tracer studies, Susquehanna River, Rivers, Saline water.

Nonlinear parameter estimation techniques were applied to obtain optimum values and confidence intervals for mass sedimentation rates in Chesapeake Bay from Pb210, Cs137 and Pu239, 240 geochemical tracer profiles. The results show high sedimentation rates of around 0.3-1.2 g/sq cm/year for the upper bay, modest sedimentation rates of 0.1-0.3 g/sq cm/yr for the middle bay, and modest to high sedimentation rates of 0.1-0.8 g/sq cm/yr for the lower bay. The principal source for the upper bay is the Susquehanna River discharge and that for the lower bay is the ocean and lower bay environment. In terms of total sediment budget the results are in agreement with published eivdence that episodic sedimentation events are an important feature of the bay system. (Author)
W86-02077

ROLE OF FLOCCULATION IN THE FILTERING OF PARTICULATE MATTER IN ESTUARIES,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
K. Kranck.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 159-175, 6 fig, 44 ref.

Descriptors: *Estuaries, *Filtration, *Particulate matter, *Flocculation, *Sedimentation, Suspended sediments, Sediments, Rivers, Saline water, Particle size, Sediment transport, Settling velocity, Organic matter.

The structuring of suspended particulate matter in estuaries into flocculated settling entities is described and discussed. A hierarchy of three particle distribution types is described: in situ distributions contain abundant large low density fragile aggregates (macro-flocs) with high settling rates, the formation of which is promoted by low turbulence and high particulate concentrations. During periods of high currents in nature and during shipboard and laboratory sample handling, these macro-flocs break up into more stable distributions of smaller flocs which are the basic building blocks of the larger units. Laboratory oxidation of organic matter and disaggregation of aggregates allow the size analysis of individual single mineral grain distributions for purposes of direct comparison between bottom and suspended sediment spectra. The constituent grain-size distribution of the inorganic component of a floc replicates the grain
of the suspension as a whole. The diverse grain
and chemical nature of the organic matter m
its flocculation kinetics more complicated.
laboratory experiments have indicated the
ence of organic-inorganic proportions optimu
flocculation. This is substantiated by ash-loss
from three estuaries with different relative i
of organic and inorganic matter. The partic
matter in each was dominated by similar org
inorganic proportions (65%-75% organic m
by volume) indicating that the componen
excess of this value had been preferentially ex
ed from the estuary. Settling of suspended
ment as macro-flocs and near bottom break-up
resuspension of floc fragments control the
dynamic equilibrium between particle trapping
particle flushing in estuaries. (Author)
W86-02078

**FATES OF URANIUM AND THORIUM DE
SERIES, NUCLIDES IN THE ESTUARINE
VIRONMENT,**
State Univ. of New York at Stony Brook. Ma
Sciences Research Center.
J. K. Cochran.
IN: The Estuary as a Filter, Academic Press,
lando, FL. 1984. p 179-220, 10 fig, 1 tab, 66
OCE76-02-39.

Descriptors: *Estuaries, *Filtration, *Radio
topes, *Tracer studies, Sedimentation, Uranium
dioisotopes, Thorium radioisotopes, Radium
dioisotopes, Lead radioisotopes, Polonium ra
sotopes, Sediments, Suspended sediments, Mix
Organic matter, Saline water, Bottom sedim
Sediments, Rivers, Radon, Aquatic life, Ben
fauna.

Naturally occurring radionuclides of the uran
and thorium decay series are useful in study
estuarine geochemical processes ranging from
removal of reactive nuclides from the w
column to the mobilization and transport of ch
cal species in the sediment column. Although
nium isotopes generally show conservative bel
ior during estuarine mixing, removal from solu
can occur at low salinities or in estuaries hig
dissolved organic matter. Uranium in estua
sediments also displays a diagenetic chemi
linked to oxidation-reduction. In contrast to u
um, radium isotopes are released during estua
mixing. Mechanisms of release include desorp
from suspended sediments and the mobilizatio
radium from bottom sediments. The latter is d
onstrated by measurements of Ra226 and Ra22
sediment pore waters. The thorium isoto
Th234 and Th228, produced by decay of solu
parents U238 and Ra228, are good analogs
chemical species which interact strongly with
ticles in the estuary. Both have been used to
mate removal times of thorium from solution
particles. The distribution of Th234 and Th22
sediments is governed primarily by particle mi
by the benthic fauna, and both isotopes serve
chronometers to determine mixing rates. Pb
and its daughter Po210 also serve as tracers
reactive nuclides. Both are removed rapidly
bottom sediments. Although Pb210 is a lon
lived tracer than Th234 or Th228, its depth dis
bution in estuarine sediments is also affected
bioturbation. Successful reconstruction of sedim
chronology in the estuary thus requires the ap
cation of several tracers with different half-li
and independent information on the sedim
budget of the area. (Author)
W86-02079

**RESPONSE OF NORTHERN SAN FRANCIS
BAY TO RIVERINE INPUTS OF DISSOLV
INORGANIC CARBON, SILICON, NITROG
AND PHSOPHORUS,**
Geological Survey, Menlo Park, CA.
L. E. Schemel, D. D. Harmon, S. W. Hager, and
D. H. Perterson.
IN: The Estuary as a Filter, Academic Press,
lando, FL. 1984. p 221-240, 6 fig, 1 tab, 29

Descriptors: *Estuaries, *Filtration, *Nutrie
Dissolved solids, Silicon, Nitrogen, Phosphor
San Francisco Bay, Sacramento River, San Joq

River, San Pablo Bay, Suisun Bay, Rivers, Solute ransport, Seasonal variation, Water quality, Saline vater, Biological filters, Phytoplankton.

Estuarine processes can be effective in modifying filtering) distributions of dissolved inorganic orms of carbon, silicon, nitrogen, and phosphorus n northern San Francisco Bay. During winter, igh inflow from the Sacramento-San Joaquin iver system supplied these nutrients to the estuary t rates that exceeded potential rates of estuary upply and removal processes. During spring and ummer, when inflow rates were lower, the estu- ry was an effective filter of the river inflow signal ecause rates of estuarine processes were high elative to river and other supply rates. At lower nflow rates, the river apparently influenced estua- ne hydrodynamic feeatures that controlled rates f phytoplankton nutrient removal. Largest biolog- al removal effects were localized in San Pablo ay during spring and Suisun Bay during summer, nd they were generally more pronounced in shal- w water areas of the bays. In San Pablo Bay, ffects of biological removal appeared soon after ver inflow decreased from high winter rates, but ersisted for only a short time. During the follow- g summer months dissolved nitrogen and dis- lved phosphorus distributions in San Pablo Bay dicated that estuarine sources contributed to igher concentrations of these nutrients. (Author) 86-02080

STUARINE INTERACTION OF NUTRIENTS, RGANICS, AND METALS: A CASE STUDY IN HE DELAWARE ESTUARY,
elaware Univ., Lewes. Coll. of Marine Studies.
H. Sharp, J. R. Pennock, T. M. Church, J. M. ramontano, and L. A. Cifuentes.
N: The Estuary as a Filter, Academic Press, Or- ndo, FL. 1984. P 241-258, 10 fig, 23 ref. A80AA-D-00106.

escriptors: *Estuaries, *Fate of pollutants, *Fil- ations, *Nutrients, Phytoplankton, Metals, Heavy etals, Delaware Estuary, Geochemistry, Nutri- nts, Organic matter, Phosphates, Humic acids, rticulate matter, Dissolved solids, Rivers, Saline ater, Iron, Phosphates, Ammonium compounds, rea, Silicates, Nickel, Copper.

he geochemical and the biochemical processes hich alter concentrations of soluble nutrients, rganic matter, and trace metals were studied in e Delaware Estuary using property-salinity plots. eochemical filtration occurred primarily in the w salinity upper estuary, where particulate con- ntrations were highest because of flocculation d resuspension of bottom sediments. Biochemical tration occurred primarily in the low salinity per property-salinity plots. Geochemical filtra- n occurred primarily in the low salinity upper tuary, where particulate concentrations were ghest because of flocculation and resuspension of ttom sediments. Biochemical filtration occurred edominantly in the lower estuary, where biologi- l productivity was highest. Geochemical filtra- n was studied with organic matter, iron, and osphate. Dissolved organic matter and humic id concentrations decreased with increasing sa- ity; amino acids generally increased with in- easing salinity. Iron and phosphate concentra- ns decreased with increasing salinity. However, e steady-state lower limit was higher for iron (30 M) than for phosphate (1 nM). This was attrib- ed to the phosphorus buffer effect. Geochemical moval was most apparent during winter. Bio- emical filtration was studied with nutrients and ce metals. In spring concentrations of ammoni- , phosphate, silicate and urea decreased to arly zero at a salinity of about 15. Phytoplankton tivity was highest in the region of 10-22 salinity. ckel and copper showed little filtration, despite ir potential for bioreactivity. Cadmium and sophate concentrations illustrated a combined geochemical filter, with geochemical exchange minant at lower salinities and biochemical activi- dominant at higher salinities. (Cassar-PTT) 86-02081

TUARINE TOTAL SYSTEM METABOLISM ND ORGANIC EXCHANGE CALCULATED FROM NUTRIENT RATIOS: AN EXAMPLE FROM NARRAGANSETT BAY,
Rhode Island Univ., Narragansett. Graduate School of Oceanography.
S. W. Nixon, and M. E. Q. Pilson.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 261-290, 9 fig, 2 tab, 50 ref.

Descriptors: *Estuaries, *Filtration, *Organic matter, *Nutrients, *Narragansett Bay, *Rhode Island, Nitrogen, Phosphorus, Denitrification, Sedimentation, Mixing, Phytoplankton, Productivity, Metabolism, Saline water.

The system metabolism of Narragansett Bay, Rhode Island, was calculated from the annual nutrient input, the ratio of the annual time and volume-weighted mean concentrations of dissolved inorganic nitrogen and dissolved inorganic phosphorus, the annual rate of denitrification, and data on the chemical composition of the plankton. Results showed that the system is autotrophic, with net production exceeding consumption by about 80 g C per sq m per year. The amount or organic matter exported from the bay is 70-75 g C per sq m per year, equivalent to 22-24% of the phytoplankton production. Estimated accumulation in the sediments is about 6 g C per sq m per year; estimated removal by fisheries is about 1 g C per sq m per year. (Cassar-PTT)
W86-02082

ANTHROPOGENIC NITROGEN LOADING AND ASSIMILATION CAPACITY OF THE HUDSON RIVER ESTUARINE SYSTEM, USA,
Maryland Univ., Cambridge. Center for Environmental and Estuarine Studies.
T. C. Malone.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 291-311, 8 fig, 1 tab, 37 ref.

Descriptors: *Estuaries, *Fate of pollutants, *Filtration, *Nitrogen, Wastewater disposal, Hudson River Estuary, Phytoplankton, Productivity, Dissolved oxygen, Oxygen, Saline water.

The fate of sewage-derived nitrogen was studied in the Hudson River Estuary. Net export of nitrogen was negligible during March-October. During this period sewage-nitrogen accounted for 54% (March-May) to 121% (June-October) of new production. During the remainder of the year most new nitrogen was exported to adjacent coastal water with little uptake by the plume. Estimated increases in new production as a result of sewage-nitrogen loading were 77 million kg C during March-May and 94 million kg C during June-October. This was a 30% increase in phytoplankton production over the predischarge levels of 578 million kg C per year. During summer, when the phytoplankton production was highest, nitrogen was exported as plankton biomass or as fecal material. The increased phytoplankton production in response to sewage-nitrogen had little effect (about 30%) on dissolved oxygen levels because over 80% of phytoplankton production is metabolized within the plume before reaching the bottom waters. (Cassar-PTT)
W86-02083

ESTUARY EXTENDED - A RECIPIENT-SYSTEM STUDY OF ESTUARINE OUTWELLING IN GEORGIA,
Georgia Univ., Sapelo Island. Marine Inst.
C. S. Hopkinson, and F. A. Hoffman.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 313-330, 1 fig, 5 tab, 36 ref.

Descriptors: *Estuaries, *Filtration, *Marshes, *Organic carbon, Georgia, Rivers, Saline water, Organic matter, Productivity, Sedimentation, Respiration, Aquatic life, Nearshore processes, Salt marshes.

Organic carbon budgets are presented for the marsh, estuarine water bodies and the inner portion of the nearshore region of Georgia. Budgets were determined by balancing external inputs and outputs from rivers and the mid-shelf against measurements of community production, metabolism and internal organic matter storage. On the marsh, primary production exceeds sedimentation and respiration by a factor of 2.6. The aquatic system is distinctly heterotrophic, with the primary production to community respiration ratio being 0.63:1. The current best estimate is that the autotrophic marsh-estuarine system has 947 g C per sq m potentially available for export. The nearshore system requires an input of 210 g C per sq m per year in addition to primary production to sustain its high rate of community production. Allochthonous organic inputs from rivers constitute 12% of total inputs to the marsh/estuarine/nearshore interface system. Roughly 50% of carbon inputs to the interface system are unaccounted for. About 10% of net primary production of the marsh must be exported to sustain heterotrophic levels in the estuarine aquatic system and the nearshore. The nearshore region is a component of a coupled system and is strongly dependent on the adjacent marsh/estuary and river for a portion of its organic matter. As such, the nearshore can be considered as a functional extension of the estuary into the ocean. The estuary is a filter in the sense that materials received at the land-sea interface will be processed, transformed and exchanged within the marsh/estuary and the nearshore zones. (Author)
W86-02084

SURFACE FOAM CHEMISTRY AND PRODUCTIVITY IN THE DUCKABUSH RIVER ESTUARY, PUGET SOUND, WASHINGTON,
Washington Univ., Seattle. Coll. of Ocean and Fishery Sciences.
R. C. Wissmar, and C. A. Simenstad.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 331-348, 3 fig, 5 tab, 42 ref. R/F-37.

Descriptors: *Estuaries, *Filtration, *Organic matter, Foaming, Nitrogen, Chlorophyll, Adenosine triphosphate, bacteria, Sediments, Duckabush River, Hood Canal, Puget Sound, Washington, Productivity, Neritic environment, Algae, Eelgrass, Phytoplankton.

Chemical and biotic constituentsof surface foam were compared in estuarine and neritic waters of Puget Sound, Washington. The role of surface foam formation as a major filtering medium in an estuary was indicated by entrainment and concentration of constituents in foam several times higher than that of subsurface and neritic waters. Stable carbon isotopic ratios and organic solute fractions (hydrophobic and hydrophilic) indicated that organic matter in foams originated from dissolved organic carbon compounds released from seagrasses and benthic algae. Concentrations of particulate oranic carbon and nitrogen, chlorophyll a, adenosine triphosphate, and bacteria counts showed enrichment in foams due to entrained sediment particles, algae, and bacteria. Inorganic nutrient concentrations, primary production and respiration rates of estuarine foam were also several-fold greater than neritic waters. The high levels of organic and inorganic chemical constituents, and metabolic rates of the microbial community indicate that surface foams are important interfaces for cycling of nutrients, formation of detrital matter, and production of microbial forage for consumers. (Author)
W86-02085

MICROBIOLOGICAL CHANGES OCCURRING AT THE FRESHWATER-SEAWATER INTERFACE OF THE NEUSE RIVER ESTUARY, NORTH CAROLINA,
East Carolina Univ., Greenville, NC. Dept. of Biology.
R. R. Christian, D. W. Stanley, and D. A. Daniel.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 349-365, 2 fig, 3 tab, 32 ref. NA83AA-D-0012.

Descriptors: *Estuaries, *Filtration, *Bacteria, *Saline-freshwater interfaces, *Neuse River Estuary, *North Carolina, Nitrates, Phosphates, Phytoplankton, Productivity, Chlorophyll, Nitrogen.

The hypothesis that mass mortality of freshwater phytoplankton at the freshwater-saltwater interface causes rapid biogeochemical changes was

tested. Physical, chemical, and microbiological variables were studied in the Neuse River Estuary, North Carolina. Nitrate nitrogen, orthophosphate, and number of phytoplankton taxa all decreased significantly going downriver across the freshwater-seawater interface, while bacterial density and productivity rose sharply. Parameters which did not change significantly were phytoplankton density, chlorophyll a, ammonia nitrogen, and light absorption coefficient. In laboratory studies, increasing salt concentration from zero to 4 ppt produced slightly lower bacterial density and slightly higher bacterial productivity. In the same studies the following parameters were unaffected by the change from freshwater to saline water: primary productivity, chlorophyll concentration, number of phytoplankton taxa, ammonium-N uptake, and nitrate-N uptake. No evidence was found to confirm the hypothesis that salt at the interface affects the microbial community. (Cassar-PTT)
W86-02086

INFLUENCES OF SUBMERGED VASCULAR PLANTS ON ECOLOGICAL PROCESSES IN UPPER CHESAPEAKE BAY,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
W. M. Kemp, W. R. Boynton, R. R. Twilley, J. C. Stevenson, and L. G. Ward.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. P 367394, 6 fig, 2 tab, 73 ref. R80593200.

Descriptors: *Estuaries, *Filtration, *Aquatic plants, *Sediments, Submerged plants, *Organic matter, Suspended sediments, Sediments, *Chesapeake Bay, Potamogeton perfoliatus, Ruppia maritima, Phytoplankton, Turbidity, Fish, Aquatic animals, Vegetation effects, Waterfowl, Nitrogen, Phosphorus, Nutrients, Oxygen demand, Productivity, Decomposition.

Physical, chemical and biological influences of submersed vascular plants (dominated by Potamogeton perfoliatus and Ruppia maritima) on their surrounding environment are summarized for portions of Upper Chesapeake Bay. Rates of accretion of organic matter in these ecosystems were high owing to the combined effects of vascular plant and associated algal production and the trapping of particulate organics of phytoplanktonic origin. Time-series observations of seston along transects traversing vegetated bottoms indicated significantly less turbid water over the plant beds, due both to increased deposition and to decreased resuspension of fine-grain sediments. Submersed plants provided a preferred habitat for many animal populations, and abundance of fishes (predominantly juveniles) was significantly greater in these plant beds than in adjacent unvegetated areas. Recent declines in several species of migrating waterfowl which feed directly on plant material were highly correlated with contemporaneous decreases in plant distribution. Rapid uptake of dissolved inorganic nitrogen and phosphorus was demonstrated for these communities, with subsequent incorporation into plant material via both growth and facultative increases in percent N and P composition. Upon senescence and death, submersed vascular plants contributed 33% to the organic C budget, while acting as a seasonal sink for 210% and 7% of the total sediment and nitrogen inputs, respectively, to the estuary. (Author)
W86-02087

SEAGRASS FILTER: PURIFICATION OF ESTUARINE AND COASTAL WATERS,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
F. T. Short, and C. A. Short.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 395-413, 5 fig, 1 tab, 46 ref.

Descriptors: *Estuaries, *Filtration, *Sedimetation, *Aquatic plants, *Nutrient removal, Particulate matter, Seagrass, Vegetation effects, Silt, Clays, Organic matter, *Indian River, *Florida, Suspended sediments, Sediments, Nitrogen, Phosphates, Saline water.

Sediment removal and nutrient removal were studied in tanks planted with seagrass. Light penetration to specified depth of the tank increased more rapidly with time in seagrass tanks than in uplanted tanks. Halodule wrightii had a greater sediment trapping effect than Syringodium filiforme. Terrestrial organic silt was more readily settled than the other forms of ammonium chloride and sodium phosphate. The rate of phosphate removal was similar in seagrass and nonvegetated tanks (from 2 to 1 micromoles in three hours). Ammonium concentrations were reduced from 10 to 1 micromoles in seagrass tanks within 1.5 hours; from 10 to 6 micromoles in the control tank. Results were extrapolated to field conditions in Indian River Lagoon, Florida. Nitrogen removal in that seagrass community was calculated to be 3890 metric tons of N annually, 1860 tons of this during May-July. This nitrogen removal represents 11% of the nutrient load to the Indian River. However, excessive loading of nutrients or suspended material is detrimental to the seagrass community, promoting loss of the vegetated beds and their filtering mechanism. (Cassar-PTT)
W86-02088

BIOLOGICAL AND PHYSICAL FILTERING IN ARID-REGION ESTUARIES: SEASONALITY, EXTREME EVENTS, AND EFFECTS OF WATERSHED MODIFICATION,
San Diego State Univ., CA. Dept. of Biology.
J. B. Zedler, and C. P. Onuf.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 415-432, 5 fig, 2 tab, 22 ref. R/CZ-33c & R/CZ-51.

Descriptors: *Estuaries, *Filtration, *Sedimentation, Watershed, Enviromental effects, Suspended sediments, Sediments, Saline water, Semiarid lands, Tijuana Estuary, Mugu Lagoon, Colorado Lagoon, *California, Floods, Construction, Aquatic habitats, Habitats, Storms, Seasonal variation, Tidal effects, Nutrients, Channels, Marshes, Salt marshes, Invertebrates.

The filtering functions occurring in the arid region estuaries of southern California were reviewed using data from three tidally flushed systems: Tijuana Estuary, Mugu Lagoon, and Colorado Lagoon. Three hypotheses were developed. (1) The biological and physical filters differ significantly in wet and dry seasons. During the wet season plants take up nutrients, animals consume organic carbon, and sediments are deposited in channels. During the dry season no nutrients are input from the watershed. Organisms continue to filter materials from the water. The filtering function is one of nutrient uptake and recycling rather than tapping of imported particulate organic matter. (2) Extreme events such as floods substantially alter estuarine structure and fuctioning. In channels, sedimentation and salinity reduction can eliminate both plant and animal communities. In salt marshes reduced soil salinity and possibly increased nutrient levels produce increased vascular plant growth and establishment of cordgrass. (3) The combination of extreme events with hunman disturbance in the watershed has the potential for long-term consequences in the estuaries. For example, accelerated erosion from construction increases sedimentation, reducing the water depth and eliminating fish and eelgrass beds in favor of a subtidal habitat. A reservoir drawdown, prolonging the wet season, can eliminate the halophyte community. (Cassar-PTT)
W86-02089

ASSESSING AND MANAGING EFFECTS OF REDUCED FRESHWATER INFLOW TO TWO TEXAS ESTUARIES,
National Coastal Ecosystems Team, Slidell, LA.
For primary bibliographic entry see Field 6G.
W86-02090

DETERIORATION OF COASTAL ENVIRONMENTS IN THE MISSISSIPPI DELTAIC PLAIN: OPTIONS FOR MANAGEMENT,
Louisiana Universities Marine Consortium, Chauvin.
For primary bibliographic entry see Field 6G.
W86-02091

ENVIRONMENTAL CHARACTERIZATION CHESAPEAKE BAY AND A FRAMEWO FOR ACTION,
Environmental Protection Agency, Annap MD. Chesapeake Bay Program.
V. K. Tippie.
IN: The Estuary as a Filter, Academic Press, lando, FL. 1984. p 467-487, 7 fig, 2 tab, 4

Descriptors: *Estuaries, *Water pollution sou *Fate of pollutants, *Filtration, Metals, Org compounds, Water pollution control, Water ity, Management, *Chesapeake bay, Aquatic Shellfish, Fish, Aquatic animals, Aquatic pl Algae, Oysters, Submerged plants, Sediments, trients, Nitrogen, Phosphorus, Dissolved oxy Oxygen.

Data compiled and analyzed during the E Chesapeake bay Program show how the filte action responsible for the estuary's high produ ity also traps pollutants. The bay's ecology gradually changed as follows: blue-green blooms have increased in frequency; subme aquatic vegetation has declined dramatically, ticularly in the upper bay and western shore t taries; freshwater-spawning fish have decli while marine-spawning fish have increased; oyster spat set has decreased significantly as crab harvests have increased. Nutrient levels high in the upper bay and tributaries, modera the eastern shore area, and normal in the lo bay. The amount of water in the main part o bay which has low or no dissolved oxygen increased 15-fold between 1950 and 1980. concentrations of toxic organic compounds a bottom sediments of the main bay near indus facilities, near river mouths, and in areas of m mum turbidity. Metal concentrations are sig cantly higher than background levels in m areas; the Patapsco and Elizabeth Rivers b most highly contaminated. To reverse the de of this ecosystem, inputs of nutrients and t materials must be controlled. Nutrient loadings be reduced by implementing agricultural ru control, urban runoff control, and point so control of industrial and wastewater treatm plant discharges. Metal loadings from point nonpoint sources are already being reduced the aid of the metal contamination index, the to ity index, and effluent/sediment testing pr dures. (Cassar-PTT)
W86-02092

ENVIRONMENTAL IMPACT OF POLLUTI CONTROLS ON THE THAMES ESTUA UNITED KINGDOM,
Thames Water Authority, Reading (England).
For primary bibliographic entry see Field
W86-02093

NUTRIENT AND DETRITUS TRANSPORT THE APALACHICOLA RIVER, FLORIDA,
Geological Survey, Tallahassee, FL. Water sources Div.
For primary bibliographic entry see Field 5B.
W86-02356

HYDRAULIC AND SEDIMENT CHARACT ISTICS AT THE NORTH CHANNEL BRID JAMAICA BAY, NEW YORK,
Geological Survey, Albany, NY. Water Resou Div.
For primary bibliographic entry see Field 2J.
W86-02412

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALTING BY REVERSE OSMOSIS YUMA DESALTING PLANT,

Bureau of Reclamation, Yuma, AZ. Yuma Projects Office.
K. M. Trompeter, and S. H. Suemoto.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 427-437, 5 fig.

Descriptors: *Saline water, *Salinity, *Desalination, Desalination plants, Desalination apparatus, Colorado River, Reverse osmosis, Legal aspects, Yuma, Arizona.

This paper presents the pretreatment and desalting systems at Yuma Desalting Plant at Yuma, Arizona. This discussion of processes includes sedimentation, partial lime softening, filtration, scale inhibitors, and reverse osmosis desalting. Other plant features are office, maintenance areas, computer control, energy recovery, and improving performance of treatment by use of Test Train. The key feature of the desalting plant is the reverse osmosis desalting equipment, with a capacity of 22.4 million-gallons-per day. The present status of constructin including anticipated start-up and completion dates, and an update of capital, operation, and maintenance costs, is also presented. (Halterman-PTT)
W86-02319

3B. Water Yield Improvement

CPP DATA COLLECTION AND ANALYSIS FOR THE PERIOD 1 JANUARY 1979 THROUGH 30 SEPTEMBER 1984: VOLUME ONE - EXECUTIVE SUMMARY,
Atmospherics, Inc., Fresno, CA..
For primary bibliographic entry see Field 2B.
W86-01984

ROOFTOP RAINWATER CATCHMENT SYSTEMS FOR DRINKING WATER SUPPLY,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
J. J. Schiller.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 85-100, 13 fig, 9 ref.

Descriptors: *Water supply, *Drinking water, Water conveyance, *Water storage, *Storage tanks, Potable water, Water supply development, Water tanks, Rain, Design criteria, Developing countries, Cisterns, Water demands, Computer models.

In developing countries where the fetching of water is time consuming, rooftop rainwater catchment systems (RWCS) can be a valuable asset. Rainwater catchments are a form of renewable energy technology, using solar energy, which evaporates surface water, both purifying and elevating it. Components of the RWCS are: a catchment device, a conduit system, and a storage tank. In designing such systems the components must be of adequate size and strength to provide the optimum amount of potable water at the most economical cost. A reasonable water demand will have to be selected for design considerations. The time variation of rainfall (RF) is important in designing a RWCS, because the storage tank must be designed to trap the excess rainfall for use in dry periods. Planned rationing can greatly alter the reliability of a system. The first step in designing a RWCS is to determine whether RWCS' are feasible in a given area. To correctly design a RWCS, it is necessary to take into account the variability in the particular RF pattern. Computer modeling with historical RF data is described. Another approach is to apply statistical methods to the design of RWCS systems. Several devices have been used to divert the dirt that accumulates on rooftops and is present in the first runoff of rainwater. The RWCS tank should be cleaned annually. (Geiger-PTT)
W86-02330

3C. Use Of Water Of Impaired Quality

COLORADO RIVER SALINITY - THE USER'S PERSPECTIVE,
Colorado River Board of California, Los Angeles.
For primary bibliographic entry see Field 5B.
W86-02265

IRRIGATION WITH SALINE GROUNDWATER AS A STRATEGY FOR SALINITY CONTROL IN THE SHEPPARTON REGION OF NORTHERN VICTORIA,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
R. A. Wildes.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 225-264, 2 tab, 15 ref.

Descriptors: *Salinity, *Saline water, *Water quality control, Groundwater, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agricultural hydrology, Agriculture.

A strategy for salinity control based on private groundwater pumping and the direct, on-farm use of the water for irrigation is described. The major advantage of the on-farm approach to salinity control are that saline drainage flows to the Murray River are minimized while agricultural productivity is improved through the increased availability of irrigation water. The specific benefits include matching irrigation water salinity to suit particular crops, soils, and management methods; maximizing the productive use of groundwater, thus minimizing the amount of salt input to the Murray River; farmer-owned and operated pumps cost less than state-owned pumps; on-farm methods potentially apply to the whole area of the irrigated lands; and greater flexibility of irrigation management including the opportunity to irrigate during winter. (Halterman-PTT)
W86-02287

LIVING WITH SALINITY: AN EVALUATION OF TWO POLICY MEASURES WITHIN A REGIONAL FRAMEWORK.
Hebrew Univ. of Jerusalem (Israel). Dept. of Agricultural Economics.
D. Yaron, and A Ratner.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston, 1984. p 441-454, 1 fig, 4 tab, 15 ref.

Descriptors: *Salinity, *Saline water, Legal aspects, Jurisdiction, Water rights, Water use, Impaired water use.

Two analyses of policy measures aimed at compensating for, or reducing, salinity-induced losses in agriculture are described. The extent of income losses due to salinity depends on: the mix of crops, their sensitivity and income potential; the share of value added in gross output value; and the degree of the farm's adaptation to salinity. With regard to the latter, distinction must be made between: currently practiced crop mix and irrigation technology; crop mix adapted to salinity and currently practiced irrigation technology; and both crop mix and irrigation technology adapted to salinity. The first policy discussed is compensation for increased water salinity, which would become critical for a region when water rights are firmly practiced, and water quality deteriorates. The second policy discussed pertains to the determination of the optimal water quantity-salinity mix for a region and regional co-operation. This issue becomes important when a region can be supplied with more water, but at the cost of increased salinity. Various applications of these policies are discussed and several mathematical treatments are illustrated. (Halterman-PTT)
W86-02304

IRRIGATION AS A SOLUTION TO SALINITY PROBLEMS OF RIVER SYSTEMS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
G. R. Dutt, D. A. Pennington, and F. Turner.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 465-472, 8 tab, 8 ref.

Descriptors: *Salinity, *Saline water, *Irrigation, Irrigation engineering, Irrigation operation, Irrigation practices, Irrigation-return flow, Water use, Impaired water use.

Saline waters diverted from river systems to maintain water quality usually can be used for the production of salt tolerant crops. Irrigation by saline waters has been shown to be economically feasible in Arizona. The establishment of saline irrigation projects with their accompanying drainage systems and brine disposal facilities can economically use most waters being diverted from river systems. Field data corroborating these conclusions are provided for cotton, barley, sorghum and sugar beets. (Halterman-PTT)
W86-02305

USE OF SALINE WASTE WATER FROM ELECTRICAL POWER PLANTS FOR IRRIGATION,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
R. J. Hanks, R. F. Nielson, R. L. Cartee, and L. S. Willardson.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 473-482, 8 fig, 1 tab, 4 ref.

Descriptors: *Salinity, *Saline water, Irrigation, Irrigation engineering, Irrigation operation, Irrigation practices, Water use, Impaired water use.

Water is generally re-cycled in the evaporation-cooling system of power plants until the salinity of the water reaches a high level, at which time it is disposed of as waste water. The possible disposal of saline waste water from power plants by irrigation of crops is discussed, and is shown to be an economically sound disposal method. The long-term effects of salt and specific ions on the soil and crops are relatively unknown. Five years of experience at Huntington, Utah shows a stability in production for forage and grain crops but a continuing production decrease on root crops. Work will continue, and specific ion effects will be evaluated, to determine their importance for long-term management. (Halterman-PTT)
W86-02306

AQUATRAIN PIPELINE SYSTEM,
Bureau of Reclamation, Denver, CO. Office of Saline Water Transport and Use.
M. J. Clinton, and I. E. McKeever.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 483-492, 1 fig.

Descriptors: *Salinity, *Saline water, Colorado River, Water use, Impaired water use, Salvaged water, Conveyance structures, Pipelines, Resource development, Hydraulic engineering.

The AQUATRAIN project, a proposed pipeline system to help control Colorado River salinity, and economically transport coal to markets, is discussed. The primary goals are: to collect saline water in the Colorado River basin, transport it to points of most beneficial use, and dispose of it in the most cost effective manner; and to provide an economically competitive method of moving coal and other commodities from source points to markets, using a part of the savings in commodity transport costs to pay for the salinity control function. Sources and markets, pipeline corridor selection, program status and schedule, costs, and public involvement in the AQUATRAIN Process are discussed. (Halterman-PTT)
W86-02307

SALT GRADIENT SOLAR PONDS.
Department of Energy, Washington, DC.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 493-502, 5 fig,

1 tab.

Descriptors: *Salinity, *Saline water, *Electric power production, *Solar energy, Water use, Impaired water use, Resource development, Brine disposal.

Various aspects of the possible use of impounded brackish water for a solar power generation facility are discussed. Highly brackish water which would normally flow into the Wichita River, from a variety of sources, would instead be impounded into a solar pond. The solar pond is a device for trapping and storing solar thermal energy. The proposed salt gradient solar pond achieves this by means of a salt concentration gradient, increasing from low salinity at the surface to high salinity a meter or two below the surface. Hence deeper waters are heavier than waters above them, impeding upward movement of warmed water. Thus, the principal mechanism of heat loss in ordinary ponds is impeded. In this manner, temperatures can reach the boiling point of saline water. Coupling the pond with an organic Rankine-cycle engine will produce electricity. The feasibility is discussed in detail. (Halterman-PTT)
W86-02308

REUSING SALINE DRAINAGE WATERS FOR IRRIGATION: A STRATEGY TO REDUCE SALT LOADING OF RIVERS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
J. D. Rhoades.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston, 1984. p 455-464.

Descriptors: *Salinity, *Saline water, *Irrigation, Irrigation engineering, Irrigation operation, Irrigation practices, Irrigation-return flow, Water use, Impaired water use.

Several strategies for coping with increasing levels of salinity in river systems resulting from irrigation are discussed. Emphasis is on irrigation with saline drainage water, and cycling crop types. The process works by intercepting drainage returns before they flow back into the river, and using them for irrigation. When the water is of such poor quality (high salinity) that it is no longer usable, it is pumped into evaporation ponds. Water is conserved and salt loading is minimized by this process. The efficiency of this strategy is maximized when salt sensitive crops irrigated with river water, are rotated with salt tolerant crops which are then irrigated with reused irrigation water with higher salinity. (Halterman-PTT)
W86-02318

3F. Conservation In Agriculture

ADVANCES IN IRRIGATION,
Volume 2, Academic Press, New York, 1983. Edited by Daniel Hillel. 429 p.

Descriptors: *Water conservation, *Irrigation, *Soil-water-plant relationships, *Evapotranspiration, Model studies, Agriculture, Crop yield, Water stress.

This serial publication updates developments in irrigation science and practice. Irrigation scheduling with emphasis on timing criteria is reviewed. Energy consumption by irrigation, methods for conserving energy in irrigation and energy sources for future development are described. A review of crop-water production functions reveals the complexity of the interactions underlying the productive relationship between crops and irrigation water. In Australia irrigation is limited by political and economic factors. The plant-environment model, Cupid, is used to study the complete water budget of a crop. Soil variability has profound effects on irrigation efficiency. However, present methods have many problems, including the need for a large number of samples. Models based on the response functions of crops can be used to develop irrigation schedules. The dynamic crop response model, incorporated into a dynamic programming model, obtains the optimal irrigation schedule for given economic conditions. A model describing the growth and function of plants has several possible uses. Methods for determining evapotranspiration are reviewed. Remote sensing techniques can be applied to estimating crop stress and evapotranspiration. (Cassar-PTT)
W86-02123

IRRIGATION SCHEDULING: APPLIED TIMING CRITERIA,
North Dakota State Univ., Fargo. Dept. of Agricultural Engineering.
E. C. Stegman.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 1-30, 17 fig, 1 tab, 90 ref.

Descriptors: *Water conservation, *Irrigation efficiency, Crop yield, Economic aspects, Hydrologic budget, Soil water, Evapotranspiration, Water potentials, Air temperature, Temperture.

Irrigation scheduling concepts were reviewed with emphasis on timing criteria. Yield-evapotranspiration relationships show an upper-bound region for a given set of production inputs. Upper-bound yields can be attained with a variety of irrigation schedules. Maximum economic returns are usually obtained when yields are in the maximal seasonal yield region. Water balance methods of irrigation scheduling are usable with computer technology. High efficiencies (near maximum yield with minimal annual seasonal applied depth application) can be attained with a variety of methods for estimating evapotranspiration. Allowable root zone soil water depletion criteria are the most widely used methods for irrigation timing. Some improvement has been seen in several plant-based methods: evapotranspiration deficit, leaf water potential, foliage-air temperature difference. (Cassar-PTT)
W86-02124

ENERGY UTILIZATION AND MANAGEMENT IN IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. R. Gilley.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 31-59, 8 fig, 4 tab, 45 ref.

Descriptors: *Water conservation, *Irrigation efficiency, *Energy, *Fuels, Sprinkler irrigation, Surface irrigation, Pumps, Fertilizers.

An estimated 0.32 exajoules of energy was used to pump irrigation water in the U.S. in 1980. Natural gas accounts for 40.6%; electricity, 25.2% diesel, 21.7%; propane, 9.5%; and gasoline, 3%. Some methods of reducing energy use in irrigation include reduction in pumping volume (by improved irrigation efficiency or reduced net application); reduction in pumping head (by reduced-pressure sprinkler systems, replacement of sprinkler systems by surface systems, substitution of surface water for groundwater, reduction of friction in pipelines, or improved well design); improvement in pumping plant performance; less operation during peak electrical demand hours; improved fertilizer practices; and reduction in tillage. Energy saving practices are described for surface systems and for center-pivot sprinkler systems. Although sufficient conventional fuels are available, prices are expected to increase. Alcohol and wind power will be among the first renewable energy sources to become widely used, followed by biomass and solar systems. (Cassar-PTT)
W86-02125

CROP-WATER PRODUCTION FUNCTIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. J. Vaux, and W. O. Pruitt.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 61-97, 2 fig, 1 tab, 88 ref.

Descriptors: *Water conservation, *Irrigation efficiency, *Economic aspects, Water stress, Water use, Prices, Crop yield, Soil water, Evapotranspiration.

A review of crop-water production functions revealed the complexity of the interactions which underlie the productive relationship between and water in irrigated agriculture. The mecha which govern whether water is limiting or well understood, but the response of plants timing and level of moisture stressing in less u stood. Evidence indicates that the relationsh tween evapotranspiration and yield is linea that the relationship between yield and ap water is curvilinear. The factors which gove relationship between evapotranspiration an plied water are not well understood. Thus, i tors have little incentive to save water by pe ting water to limit plant moisture stress-yield tionship is unclear. The economic literature cates that water would be used more efficien agriculture if it were priced according to its scarcity value. However, risk, timing, and stage dependence must be considered before ture stressing is widely practiced. (Cassar-
W86-02126

IRRIGATION IN AUSTRALIA: DEVE MENT AND PROSPECTS,
Commonwealth Scientific and Industrial Res Organization, Griffith (Australia). Centre for gation Research.
R. C. Smith, W. K. Mason, W. S. Meyer, and D. Barrs.
IN: Advances in Irrigation, Volume 2, Acad Press, New York. 1983. p 99-153, 9 fig, 11 tab ref.

Descriptors: *Water conservation, *Irriga *Crop yield, *Soil, Clays, Australia, Past Water resources, Irrigation efficiency, Water cation, Salinity, Saline soils, Nutrients, Root Soil management, Surface irrigation.

Irrigation in Australia has been limited by pol and economic factors. Most of the irrigati used for pastures. When crops are irrigated, results are often obtained because of poorly pe able soil. Water is limited, highly-valuable, low-priced. Water allocation rules make it dif to shift the water from areas of lower product to areasof higher productivity. The Murray- ling basin contains 90% of the continent's irrig land; development here is nearly complete. main water resource potential for irrigation ex sion is in northern Australia, where crop yield low and market opportunities scarce. Soil thro out much of the continent is unsuitable for ir tion. Heavy clays with significant levels of changeable sodium and magnesium lead to p lems of low permeability. This soil can be man with minimal tillage, incorporation of crop dues, better irrigation scheduling, and nut management. (Cassar-PTT)
W86-02127

APPLICATION OF A PLANT-ENVIRONM MODEL TO PROBLEMS IN IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agronomy.
J. M. Norman, and G. Campbell.
IN: Advances in Irrigation, Volume 2, Acade Press, New York. 1983. p 155-188, 16 fig, 7 tab ref. NA 80AA-H-00087.

Descriptors: *Soil-water plant relationships, * gation, Model studies, Evapotranspiration, Eva ration, Cupid model, Canopy, Interception, drologic budget, Water loss.

The plant-environment model Cupid is useful studying the complete water budget of a c Several implications were developed. About fourth of the evapotranspiration in Nebraska-t climate is evaporation. Interception evaporatio greatest in canopies with small leaves such wheat or prairie grass, where it might reach 10 for a single event. Using air temperatures measure of plant temperature will introduce er in management because air temperature differs several degrees from those of the canopy and surface. For a wet soil surface and given atm pheric vapor pressure and temperature, evapo tion from the soil can vary from negligible to m than 50% of the evapotranspiration. Cupid reas ably predicts the canopy water balance com nents; however, the interception evaporation smaller than measurements. The model does

nsider several important factors in sufficient tail–the influence of surface residues on energy d water balances or the effects of residues, sur- e crusting, and surface slope in infiltration and noff. (Cassar-PTT)
86-02128

ELD VARIABILITY OF SOIL PHYSICAL OPERTIES,
mmonwealth Scientific and Industrial Research ganization, Wembley (Australia). Div. of oundwater Research.
r primary bibliographic entry see Field 2G.
6-02129

ONOMIC ANALYSIS OF ON-FARM IRRI- TION USING RESPONSE FUNCTIONS OF OPS,
rew Univ., Rehovoth (Israel). Faculty of Agri- ure.
Yaron, and E. Bresler.
Advances in Irrigation, Volume 2, Academic s, New York. 1983. p 223-255, 4 fig, 5 tab, 37 l append.

criptors: *Water conservation, *Irrigation, onomic aspects, *Soil-water-plant relation- s, Response functions, Model studies, Linear gramming, Dynamic programming, Production tions, Planning, Soil water, Crop yield.

integrated agrobiological-economic approach rigation is presented. Several types of models lescribed, starting with the least complex: the ro response or production function in an indi- al crop with a fixed intraseasonal distribution vater, the dated crop response functions to ation and soil moisture, and dynamic program- models for irrigation scheduling. Examples of ation scheduling include a single crop, an e farm, and irrigation in response to water . The appendix describes linear programming gives a sample situation. (Cassar-PTT)
-02130

GATION SCHEDULING BASED ON A DY- IC CROP RESPONSE MODEL,
as State Univ., Manhattan. Dept. of Industrial neering.
Raju, E. S. Lee, A. W. Biere, and E. T. masu.
Advances in Irrigation Volume 2, Academic New York. 1983. p 257-271, 4 fig, 1 tab, 6 -086-KAN. 55257-5134.

riptors: *Water conservation, *Irrigation, yield, *Soil-water-plant relationships, Dy- programming, Model studies, Economic as- Root zone.

ynamic crop response model was incorporat- o a dynamic programming model to obtain timal irrigation schedule for given economic ions. The impact of irrigation costs and grain in an irrigation strategy for maximum net per hectare can be seen as economic condi- vary. The model can be used to develop mental designs to collect data for studying namics of crop growth. The method can be ed to include dynamics of soil fertility. The accounts for several environmental factors, s soil moisture holding capacity in the root The crop response model and the evapotran- on model can be used jointly to simulate dry- ields under various conditions and to study d cropping strategies. (Cassar-PTT)
2131

EL OF ROOT GROWTH AND WATER KE ACCOUNTING FOR PHOTOSYN- S, RESPIRATION, TRANSPIRATION, OIL HYDRAULICS,
n Univ., AL. Dept. of Agonomy and Soils.
mary bibliographic entry see Field 2I.
2132

NIQUES FOR ESTIMATING IRRIGA- WATER REQUIREMENTS,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2I.
W86-02133

EVAPOTRANSPIRATION OBTAINED FROM REMOTE SENSING METHODS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 7B.
W86-02134

SALINITY CONTROL THROUGH WATER CONSERVATION IN THE UPPER COLORADO RIVER BASIN,
Utah State Univ., Logan. Coll. of Engineering.
A. B. Bishop, D. R. Franklin, and R. Narayanan.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 243-252, 2 fig, 1 tab, 3 ref.

Descriptors: *Saline water, *Salinity, *Water quality control, *Economic aspects, Model studies, Colorado River, Water conservation, Conservation, Water costs, Costs, Water demand, Dissolved solids.

The economic feasibility of public and private water conservation measures that could be employed in response to salinity control and increased water prices are discussed. Specific issues that are addressed include the total cost to the economy of the public sector investments in water conservation and other measures which reduce salinity; the water conservation measures in private agricultural and energy sectors which are economically efficient; and the benefits and costs of various government-sponsored water-saving techniques. Model simulations indicate that public investments in measures only for the sake of water conservation are not economically efficient since the marginal value of water is less than the cost of conservation. When factors that increase salinity levels are taken into consideration, however, the value of water conserved is greater than the cost of various conservation programs, because the water saved is used for decreasing the salinity levels downstream through greater dilution. (Halterman-PTT)
W86-02286

CASE STUDY OF A SALINITY CONTROL PROGRAM, VINTA BASIN, UTAH,
Soil Conservation Service, Salt Lake City, UT.
For primary bibliographic entry see Field 5G.
W86-02289

CASE STUDY OF A MAJOR AGRICULTURAL CONTROL PROGRAM - THE GRAND VALLEY EXPERIENCE,
Soil Conservation Service, Denver, CO.
M. E. Hess.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 285-294, 3 tab, 7 ref.

Descriptors: *Salinity, *Saline water, Groundwater, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agricultural hydrology, Agriculture, Colorado River.

Methodologies to control salinity in the Colorado River in the vicinity of the Grand Valley include installing structural measures to reduce seepage from unlined earthen irrigation ditches; improving irrigation water management practices to reduce deep percolation from field irrigation and to enhance uniformity of irrigation applications; and implementing a monitoring and evaluation program to assess the effectiveness of salinity control measures. The structural measures (pipelines, gated pipes, ditch lining and land leveling) have reduced salt loads by an estimated 17,500 metric tons per year. Key elements of the monitoring and evaluation program include measuring surface inflow and runoff to determine water infiltration into the ground, collecting local climatological data to evaluate crop evapotranspiration requirements (to help determine deep percolation rates), and using soil moisture sensors to assess uniformity of irrigation. The use of these data for salt loading computation under improved management practices is discussed. (Halterman-PTT)
W86-02290

SALINITY CONTROL AND DRAINAGE IN NORTHERN VICTORIA (AUSTRALIA),
Victoria State Rivers and Water Supply Commission, Armadale (Australia).
K. O. Collett, and G. C. Earl.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 315-323, 1 fig.

Descriptors: *Salinity, *Saline water, *Water quality control, Groundwater, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agriculture, Agricultural hydrology, *Australia.

Following the irrigation-related rise of the water table and increased salinity level of the ground water, a drainage strategy was developed to prevent waterlogging and control salinity. Pumping saline groundwater and draining it into the River Murray, the initial action taken, caused reduced water quality in the River Murray. On-farm measures, such as recycling, which have been demonstrated to be a partial solution to the problem, could improve the situation. Wide scale use of on-farm alternatives have not yet been put into practice. The main points concerning the current developments in salinity mitigation are: strategies based on public scale schemes may not always be able to be justified in economic terms; integrating efforts at the on-farm level with public-scale action offers possibilities for achieving salinity control and drainage objectives within economic and other constraints; and finally, there is a willingness to modify current irrigation practices in order to achieve these objectives. (Halterman-PTT)
W86-02293

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DRAINAGE BASINS IN ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02363

EVALUATION OF COMMUNITIES FOR THE APPLICATION OF LIMITED-DETAIL STUDY METHODS FOR FLOOD-INSURANCE STUDIES,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6F.
W86-02373

PHASE I SUMMARY AND PHASE II PLAN FOR COMPARING REGULATED WITH UNREGULATED STREAMFLOW IN THE YAKIMA RIVER AT UNION GAP, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
C. H. Swift.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-4015, 1985. 21 p, 5 fig, 2 tab, 8 ref.

Descriptors: River flow, *Regulated flow, *Natural flow, *River regulations, Alteration of flow, Water management (applied), Diversions, Reservoir operation, Riparian rights, Treaties, *Washington, Yakima County, Kittitas County, Yakima Indian Reservation.

A preliminary investigation of the effects of reservoir storage and canal diversion on the flow of the

Group 4A—Control Of Water On The Surface

Yakima River at Union Gap, Washington indicates that those effects are measurable and substantial--on the average causing a reduction of roughly one-quarter from the unregulated flow. Preliminary computations of the unregulated flow of the Yakima River at Parker (near Union Gap) for the 1978 water year using the U.S. Bureau of Reclamation's SSARR model indicate, however, that the computed flow figures contain inaccuracies. Further investigation of the model indicates that the inaccuracies can be substantially reduced by data checking and by using additional discharge records to improve the estimation of local inflows. (USGS)
W86-02378

EVALUATION OF THE CREST-STAGE GAGE PROGRAM IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02399

DISCHARGE RATINGS FOR CONTROL GAGES AT MISSISSIPPI RIVER LOCK AND DAM 11, DUBUQUE, IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
A. J. Heinitz.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4105, 1985. 43 p, 15 fig, 7 tab, 11 ref.

Descriptors: *Discharge coefficients, *Control-gate ratings, *Iowa, Stage-discharge relations, Tainter gate, Roller gate, Current-meter measurements, Tainter-gate opening, *Mississippi River, *Lock and Dam 11.

The water level of the navigation pools on the Mississippi River are maintained by the operation of tainter and roller gates at locks and dams. Discharge ratings for the gates on Lock and Dam 11, Dubuque, Iowa, were developed from current-meter discharge measurements made in the forebays. Methodology is given to accurately compute the vertical gate openings of the tainter gates. Discharge coeffients, in equations that express discharge as a function of tailwater depth, headwater depth, and vertical height of gate opening, were determined for conditions of submerged-orifice and free-weir flow. A comparison of the rating discharges to the theoretical rating discharges is given for submerged orifice flow for the tainter and roller gates. (USGS)
W86-02401

STATISTICAL MODELS FOR ESTIMATING FLOW CHARACTERISTICS OF MICHIGAN STREAMS,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02411

4B. Groundwater Management

SALINITY CONTROL PROBLEMS ASSOCIATED WITH IRRIGATION IN SOUTH-WEST NEW SOUTH WALES, AUSTRALIA,
Water Resources Commission of New South Wales, Sydney (Australia).
For primary bibliographic entry see Field 5B.
W86-02288

SIMULATED EFFECTS OF AN ARTIFICIAL-RECHARGE EXPERIMENT NEAR PROCTOR, LOGAN COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
A. W. Burns.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4010, 1984. 17 p, 6 fig, 3 tab, 6 ref.

Descriptors: *Artificial recharge, *Surface-groundwater relationships, Logan County, *Colorado, *Simulation analysis.

An artificial-recharge experiment was conducted near Proctor, Colorado in which a computed 620 acre-feet were pumped from a well during a 4-month period. A computed 420 acre-feet were delivered at the potential reservoir site, and the remaining 200 acre-feet leaked from the pipeline. No pond was created due to the high rates of infiltration. Water levels in the nearest well (about 0.1 mile from the recharge site) rose almost 25 feet. Computer simulations indicate that this 4-month pumping-recharge experiment would cause stream depletions from the nearby South Platte River for the first 16 months, thereafter, stream accretions due to the recharge would exceed stream depletions due to pumpage. If the experiment was conducted annually, the simulations indicate that stream depletions would occur for 6 months of each year and stream acretions for the remaining 6 months once the system reached an equilibrium condition. To reach the cyclic equilibrium condition would take at least 7 years. (USGS)
W86-02344

WATER RESOURCES OF THE RATTLESNAKE BUTTE AREA, A SITE OF POTENTIAL LIGNITE MINING IN WEST-CENTRAL, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02350

GROUND-WATER HYDROLOGY OF THE SEVIER DESERT, UTAH, WITH RESULTS OF DIGITAL-COMPUTER MODELING,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02351

PRELIMINARY STUDY OF THE AQUIFERS OF THE LOWER MESILLA VALLEY IN TEXAS AND NEW MEXICO BY MODEL SIMULATION,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02353

APPRAISAL OF THE SURFICIAL AQUIFERS IN THE POMME DE TERRE AND CHIPPEWA RIVER VALLEYS, WESTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02357

GROUND-WATER CONDITIONS AND WELL YIELDS IN FRACTURED ROCKS, SOUTHWESTERN NEVADA COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02364

GEOLOGY OF THE SURFICIAL AQUIFER SYSTEM, BROWARD COUNTY, FLORIDA,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02383

DELINEATION AND DESCRIPTION OF A ZONE OF HIGHER SECONDARY PERMEABILITY IN THE SURFICIAL AQUIFER OF EASTERN PALM BEACH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02393

MATHEMATICAL MODEL OF THE TESU AQUIFER SYSTEM NEAR POJOAQUE, MEXICO,
Geological Survey, Lakewood, CO. Wate sources Div.
For primary bibliographic entry see Field 2F.
W86-02402

SUMMARY OF RESULTS OF AN INVEST TION TO DEFINE THE GEOHYDROL AND SIMULATE THE EFFECTS OF LA GROUNDWATER WITHDRAWALS ON MISSISSIPPI RIVER ALLUVIAL AQUIFE NORTHWESTERN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Reso Div.
D. M. Sumner, and B. E. Wasson.
Available from OFSS, USGS, Box 25425, wood, CO 80225. USGS Water-Resources In gations Report 84-4343, 1984. 17 p, 10 fig, 1

Descriptors: *Groundwater availability, *I tion effects, *Model studies, *Simulation ana *Alluvial aquifers, Groundwater recharge, P tiometric level, *Mississippi, *Mississippi al plain, Yazoo Basin, Mississippi River alluvial fer.

The 7,000 square-mile Mississippi River al plain in north-western Mississippi (the Del underlain by the prolific Mississippi River al aquifer that currently (1983) yields about Mgal/d of water to irrigation wells. Comm about 20 feet of clay underlying the Delta surface is underlain by about 80 to 180 feet of and gravel that forms the aquifer. The Missi River is in good hydraulic connection wit alluvial aquifer. Generally smaller streams ar likely to have good hydraulic connection wit aquifer. Direct vertical recharge to the al aquifer is small. A two-dimensional finite-d ence computer model of the alluvial aquifer constructed, calibrated, and verified using levels observed for five dates within the p April 1981 to September 1983. The model s that the aquifer had a net loss in storage of a 360 Mgal/d for the 2-year period April 19 April 1983, when pumpage was about 1,100 M d. The net inflows from the sources of rech were: Mississippi River, 390 Mgal/d; rech along east edge of the Delta, 170 Mgal/d; str within the Delta, 81 Mgal/d; and areal rech from infiltration, 180 Mgal/d. The effects of s al levels of pumpage by wells were projecte years into the future. In 2003, the result of co ued pumpage at the 1,100 Mgal/d pumping would be lowered ground-water levels of than 20 feet in a large area in the central part o Delta, and ground-water levels would contin decline. (USGS)
W86-02405

HYDROLOGY OF PRAIRIE DOG CR VALLEY, NORTON DAM TO STATE L NORTH-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water sources Div.
L. E. Stullken.
Available from OFSS, USGS, Box 25425, L wood, CO 80225. USGS Water-Resources Inv gations Report 84-4162, 1984. 49 p, 10 fig, 1 ta ref.

Descriptors: Hydrology, Steady-state mo *Groundwater flow, Recharge, Discharge, F flow, *Hydrogeology, Water levels, *Water y *Surface-groundwater relationships, *Prairie Creek Valley, *Kansas.

Development of water resources has been a m factor in the economy of Prairie Dog Creek Va in north-central Kansas. Releases from No Reservoir to the Almena Irrigation District a aged 6,900 acre-feet per year during 1967-76. number of irrigation wells increased from 4 to during 1947-78. Ground water in the valle derived mostly from the alluvial aquifer. The fects of irrigation on the aquifer are indicated water-level changes. The water in storage creased from 130,000 to 136,000 acre-feet du 1947-78 due to recharge from surface-water ir

ion. A steady-state model of the aquifer prior to rrigation (1947) indicated that most recharge was rom precipitation (88 percent) and most discharge as to streams (54 percent) and reparian transpira-on (26 percent). Although aquifer storage in-reased in this area, storage generally decreased in ther areas of western Kansas. (USGS)
/86-02406

VALUATION OF MAJOR DIKE-IMPOUND-D GROUND-WATER RESERVOIRS, ISLAND F OAHU, WITH A SECTION ON FLOW HY-RAULICS IN DIKE TUNNELS IN HAWAII,
eological Survey, Honolulu, HI. Water Re-urces Div.
. J. Takasaki, and J. F. Mink.
vailable from Dist Branch, USGS, 604 S. Pickett , Alexandria, VA 22304. USGS Water-Supply aper 2217, 1985. 77 p, 40 fig, 12 tab, 51 ref.

escriptors: *Dikes, *Groundwater barriers, *Hy-aulics, *Groundwater storage, *Hawaii, Hydro-ology, *Oahu, Koolau Range, Waianae Range.

round-water bodies impounded by volcanic dikes nstitute important reservoirs of high-quality ter. These reservoirs have high hydraulic heads d are mostly isolated from saline water. The st important and productive of these reservoirs cur in the Koolau Range, where the top of the pounded water ranges to an altitude of at least 00 feet. The storage above sea level of these ervoirs has been roughly estimated at 550 bil-n gallons. In the Waianae Range the top of the pounded water ranges to an altitude of at least 00 feet and the estimated storage above sea level about 100 billion gallons. Water-development nels have, by breaching dike controls, reduced rage by a least 50 billion gallons in the Koolau ge and by about 5 1/2 billion gallons in the ianae Range. A significant part of the storage s reduced by each tunnel can be restored by kheading the dike or dikes which impounded most water, as indicated by flow records gath-d during tunneling. (USGS)
6-02407

OGRESS REPORT ON BLACK MESA MON-ORING PROGRAM-1984,
ological Survey, Flagstaff, AZ. Water Re-ces Div.
primary bibliographic entry see Field 2F.
-02408

OLOGY, HYDROLOGY, AND WATER ALITY OF THE CAMBRIAN AND ORDOVI-N SYSTEMS IN NORTHERN ILLINOIS,
logical Survey, Urbana, IL. Water Resources

primary bibliographic entry see Field 2F.
-02414

Effects On Water Of Man's Non-Water Activities

OROGEOLOGY AND EFFECTS OF TAIL-S BASINS ON HYDROLOGY OF SANDS IN, MARQUETTE COUNTY, MICHIGAN,
ogical Survey, Lansing, MI. Water Resources

primary bibliographic entry see Field 2F.
-01927

ECTS OF URBANIZATION OF THREE DS IN MIDDLETON, WISCONSIN,
ogical Survey, Madison, WI. Water Re-es Div.
House.
lable from OFSS, USGS Box 25425 Lake-l, CO 80225. USGS Water-Resources Investi-ns Report 84-4051, 1984. 17 p, 9 fig, 5 tab, 7

riptors: *Urbanization, Storm runoff, Urban sheds, Ponds, Watershed models, Water qual-ydrologic budget.

A digital hydrologic model was used to simulate the effects of future residential development on pond inflow volumes and resulting water levels of three ponds in Middleton, Wisconsin. The model computed the daily water budget and the resulting water level for each pond. The results of the model calibration are presented in the report, along with the existing watershed hydrologic conditions and runoff volumes for the 1982 study period. Data was collected during 1982 to claibrate the model; the data included pond stage, ground-water levels, precipitation and other meteorological characteristics. In addition, water-quality samples were collected at each pond to characterize the water quality. Simulation of pond levels with the 1982 rainfall and fully developed watersheds did not result in stages greater than those observed in 1982. Simulation of pond levels with rainfall having a 20-year recurrence interval (1978) and hypothetical, fully developed watersheds resulted in maximum pond stages above those observed in 1982. Peak stage of Tiedeman's Pond would increase by 2.77 feet, Stricker's Pond by 3.91 feet, and Esser's Pond by 1.44 feet. Simulation of pond levels with an estimated 100-year rainfall and hyopthetical, fully developed watersheds would result in peak stage increases of 5.30, 5.32, and 1.97 feet above the peak 1982 observed stages for Tiedeman's, Stricker's, and Esser's Ponds, respectively. (USGS)
W86-01949

SIMULATED EFFECTS OF SURFACE COAL MINING AND AGRICULTURE ON DISSOLVED SOLIDS IN ROSEBUD CREEK, SOUTHEASTERN MONTANA,
For primary bibliographic entry see Field 5B.
W86-01962

PARAHO ENVIRONMENTAL DATA: BIBLIOGRAPHY,
Development Engineering, Inc., Rifle, CO.
For primary bibliographic entry see Field 10C.
W86-01983

ANALYSIS OF SALT YIELDS ASSOCIATED WITH THE CONSTRUCTION AND OPERATION OF PARIETTE DRAW WILDLIFE AREA, UTAH,
Bureau of Land Management, Denver, CO.
W. L. Jackson, and S. Hudson.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 549-558, 5 fig, 1 tab, 3 ref.

Descriptors: *Salinity, *Saline water, Water pollution, Utah, Dissolved solids, Construction.

A fifty-percent increase in annual salt yield has been recorded at the downstream (7300) gage at Pariette Draw following the beginning of construction of the Pariette Draw Wildlife Management Area. This increase occurred during a period when there was a much smaller (11%) increase in salt yield at the upstream (7200) station. However, analysis of water discharge data and station salt-loading functions (Q vs. TDS) indicate that 94% of the increase in annual salt yield at the downstream station is due to the increase in mean monthly flow, following the beginning of construction of the wildlife management area, and 6% of the increase is due to a small though statistically significant (alpha=0.05) change in the salt loading function (Q vs. TDS) at the downstream station. It is hypothesized that increased inflows from Castle Peak tributary caused downstream flows during the post-construction period to increase proportionally more than flows entering the area upstream. Because the 6-year period of record is short for this type of analysis, any results or conclusions must be considered tentative. (Author)
W86-02313

SECONDARY SALINIZATION OF WATER RESOURCES IN SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
M. L. Sharma, and D. R. Williamson.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 571-580, 3 fig, 2 tab, 22 ref.

Descriptors: *Salinity, *Saline water, *Water pollution sources, *Land management effects, Groundwater, Evapotranspiration, Groundwater recharge, Groundwater movement, Australia.

Secondary salinization is a problem of considerable magnitude in southern Australia. The situation arises as a consequence of clearing of indigenous Eucalyptus vegetation for development of dryland agriculture. Because of reduced evapotranspiration from crops and pasture there is excess water available to mobilize the large mass of salts stored in the deep profiles. The current understanding of the various mechanisms involved is reviewed. The development of a quantitative approach to the salinization problem has provided a basis for establishing appropriate methods for prevention and reclamation. (Halterman-PTT)
W86-02315

MAGNITUDE AND FREQUENCY OF FLOOD VOLUMES FOR URBAN WATERSHEDS IN LEON COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02354

RAINFALL-RUNOFF RELATIONSHIPS AND WATER-QUALITY ASSESSMENT OF COON CREEK WATERSHED, ANOKA COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02370

HYDROLOGY OF AREA 60, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, NEW MEXICO, COLORADO, UTAH, AND ARIZONA,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02382

EFFECTS OF STORMWATER RUNOFF ON AN URBAN LAKE, LAKE ELLYN AT GLEN ELLYN, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02392

4D. Watershed Protection

ERODING SOILS: THE OFF-FARM IMPACTS,
Conservation Foundation, Washington, DC.
E. H. Clark, J. A. Maverkamp, and W. Chapman.
1985. 252 p.

Descriptors: *Erosion control, *Sediment transport, *Soil erosion, *Soil conservation, *Nonpoint source pollution, Agricultural engineering, Farm management, Nutrients, Nitrogen, Phosphorus, Erosion rate, Water pollution effects, Precipitation, Pesticides, Bacteria, Viruses, Streams, Lakes, Reservoirs, Economic aspects, Recreation, Sedimentation, Fish, Environmental effects, Wildlife, Water quality, Eutrophication, Salinity, Water storage, Flood damage, Canals, Contours, Terracing, Land management, Sedimentation basins, Silting.

Erosion is a major problem, not only on agricultural land, but off the farm. Among erosion's impacts are waterways polluted by sediment, fertilizers, and pesticides; accelerated siltation of reservoirs and lakes; destruction of breeding grounds for fish and other aquatic life; and increased costs for dredging harbors; siltation in rivers leading to increased flooding. This comprehensive analysis of the off-farm problems reviews basic chemical, physical, hydrological, and ecological principles pertinent to the erosion problem. Detailed cost

estimates show that erosion causes $6 billion (1980 dollars) of damages each year in the U.S. Known erosion control techniques are discussed. No single technique or group of techniques is suitable and cost effective in all situations. In general, conservation tillage and contour plowing are less expensive than structural measures such as terraces and sediment basins. Nutrient transport is most easily controlled with terraces and contour plowing. Enough information exists to mitigate the most serious erosion problems. This may involve removing the most rapidly eroding land from row-crop production or completely from production. Farm management techniques are available to control off-farm erosion impacts. However, the question is whether U.S. society has the will to implement them. (Cassar-PTT)
W86-02247

QUALITY AND QUANTITY OF URBAN RUNOFF AND ATMOSPHERIC DEPOSITION IN URBAN AREAS OF SALT LAKE COUNTY, UTAH, 1980-1981,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02346

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

PHYSICAL BEHAVIOR OF PCBS IN THE GREAT LAKES,
Ann Arbor Science, Ann Arbor, MI. 1983. 442 p. Edited by Donald Mackay, Sally Peterson, Steven J. Eisenreich, and Milagros S. Simmons.

Descriptors: *Toxic wastes, *Polychlorinated biphenyls, *Aromatic compounds, *Great Lakes, Model studies, Bioconcentration potentials, Environmental sinks, Environmental persistence, Lake Michigan, Saginaw Bay, Environmental fluctuations.

PCBs are among the most notorious environmental contaminants, and the Great Lakes are invaluable as a natural resource. This book is a collection of papers presented to increase our understanding of the environmental behavior of PCBs in the Great Lakes. The topics included in this collection of papers are high resolution PCB analysis, model studeis, bioconcentration potentials, environmental sinks, environmental persistence, environmental fluctuations, physical properties, vapor exchange, and monitoring of PCBs in the Great Lakes. (Halterman-PTT)
W86-02012

HIGH RESOLUTION PCB ANALYSIS,
Texas A and M Univ., College Station. Dept. of Veterinary Physiology and Pharmacology.
S. Safe, M. Mullin, L. Safe, C. Pochini, and S. McCrindle.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 1-13, 5 fig, 4 tab, 31 ref.

Descriptors: *Pollutant identification, *Toxic wastes, *Polychlorinated biphenyls, *High resolution analysis, *Aroclors, Gas liquid chromatography, Aromatic compounds, Toxicity, Mass spectrometry, Proton magnetic resonance.

A major problem associated with the analysis and toxicology of PCBs as well as other halogenated aromatics is the multiplicity of possible isomers and congeners. Furthermore, PCB toxicity is dependent on the structure of the individual compounds. Thus, the potential environmental and health impact of PCBs must account not only for the integrated quantification of the PCB mixtures, but also the concentrations of specific congeners which are potentially toxic. This work confirms the feasibility of high resolution PCB analysis of the commercial and environmental PCB mixtures. It is anticipated that this approach will be used to accurately measure the concentrations of specific PCB isomers and to determine the effects of PCB structures on their ecological dynamics. The methodology entails high resolution glass capillary column separation coupled with EC or MS detection and requires all 209 PCB reference standards for calibration. Data, in the form of high resolution capillary gas chromatograms, were presented for Aroclor 1016 singly and combined, as well as for a PCB fraction from a fish extract. (Halterman-PTT)
W86-02013

PHYSICAL CHEMICAL PROPERTIES OF POLYCHLORINATED BIPHENYLS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay, W. Y. Shiu, J. Billington, and G. L. Huang.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 59-69, 1 tab, 15 ref.

Descriptors: *Toxic wastes, *Polychlorinated biphenyls, Vapor pressures, Fugacity, *Solubilities, Henry's law constant, Octanol-water partition coefficient, Organic carbon sorption coefficient, Chemical partitioning, Biological magnification.

For predicting and interpreting the environmental behavior of PCBs, it is essential to have reliable data for their physical-chemical properties, notably those properties such as vapor pressure, aqueous solubility, Henry's law constant and the various partition coefficients such as those for octanol-water, organic carbon-water and biota water. Since it is not economically or practically feasible to derive these data for all 209 congeners, it is necessary to infer values for one compound from another. Results suggest that the addition of one chlorine reduces solubility and vapor pressure by approximately a factor of 3 (thus the Henry's law constant is little changed) and the octanol-water partition coefficient increases by a similar factor. The methodology for this study entailed reviewing the literature pertaining to the physical chemical properties of PCBs and compiling and statistically analyzing the available data. From these analyses selected values for the properties of congeners of Aroclor were inferred. (Halterman-PTT)
W86-02015

REACTIVITY AND ENVIRONMENTAL PERSISTENCE OF PCB ISOMERS,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
W. B. Neely.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 71-88, 2 fig, 7 tab, 23 ref.

Descriptors: *Toxic wastes, *Polychlorinated biphenyls, *Polychlorinated biphenyl isomers, *Environmental persistence, Solubility, Vapor pressure, Fish, Transport bioaccumulation, Air-water interface, Biodegradation, Water pollution.

Analyses of environmental samples have often resulted in the identification of a variety of the components of PCB fluid, ranging from unsubstituted biphenyl to the fully chlorinated homologue. These component compounds were examined in an effort to identify the properties that cause certain congeners to accumulate in environmental systems. Water solubility, vapor pressure, boiling point and rate constants for microbial degradation are presented for a large number of homologues of PCB. These values were applied to a model constructed to describe the distribution of the homologues in the water column and fishes of Lake Michigan. Values of vapor pressure, water solubility, octanol water solubility and molecular weight that are associated with optimum accumulation of PCB-related compounds in fish must be sufficiently low in order that the chemicals can build up in the various environmental compartments. (Halterman-PTT)
W86-02016

REVERSIBLE AND RESISTANT COMPONENT MODEL OF HEXACHLOROBIPHENYL ADSORPTION-DESORPTION RESUSPENSION AND DILUTION,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
D. M. Di Toro, and L. M. Horzempa.
IN: Physical Behavior of PCBs in the Great L
Ann Arbor Science, Ann Arbor, MI. 1983. p
113, 9 fig, 1 tab, 24 ref. R805229.

Descriptors: *Toxic wastes, *Hexachlorobiph
*Polychlorinated biphenyls, Adsorption, De
tion, Model studies, Suspension, Suspended
ments, Dilution, Suspended particles.

The complete understanding of the fate of
chemicals in natural waters depends, in part, o
ability to determine the rates of adsorption to
desorption from suspended particles. To this
experimental data on these variables were gat
and entered into a theoretical framework
model of adsorption and desorption of hexach
biphenyl. In addition, data were gathered o
effects of varying suspended sediment conce
tions under conditions that might be encoun
in field situations. (Halterman-PTT)
W86-02017

**PCBS IN THE LAKE SUPERIOR ATM
PHERE 1978-1980,**
Minnesota Univ., Minneapolis. Dept. of Civi
Mining Engineering.
S. J. Eisenreich, B. B. Looney, and G. J. Hollo
IN: Physical Behavior of PCBs in the Great L
Ann Arbor Science, Ann Arbor, MI. 1983. p
125, 1 fig, 2 tab, 34 ref. CR806084.

Descriptors: *Toxic wastes, *Path of pollu
*Polychlorinated biphenyls, *Lake Sup
*Great Lakes, Lake Michigan, Air Pollution,
water partition coefficients, Aerosolization,
water interface, Volatility.

Atmospheric concentrations of PCBs were
ured over Lake Superior during the summe
1978 and 1980, the years before and after the
legislated ban on their production and use.
tests were conducted to determine if the ban
ed in a decrease in the atmospheric burden of
compounds. There is no substantive indicatio
atmospheric levels of PCBs are decreasing.
board atmospheric samplers were used to me
air-borne concentrations above Lake Sup
Samples of atmosphere above Minneapolis
taken, as well, for comparison purposes.
levels over Lake Superior ranged from 0.9
ng per cu m in 1978 and ranged from 0.1 to 2
per cu m in 1980. Although the mean PCB co
tration decreased by 33%, no statistically
decrease can be assigned. The values observ
Lake Superior are similar to those observe
southern Lake Michigan. (Halterman-PTT)
W86-02018

**PCB ACCUMULATION IN SOUTHERN L
MICHIGAN SEDIMENTS: EVALUAT
FROM CORE ANALYSIS,**
Wisconsin Univ.-Madison. Water Chemistry
D. E. Armstrong, and D. L. Swackhamer.
IN: Physical Behavior of PCBs in the Great L
Ann Arbor Science, Ann Arbor, MI. 1983. p
244, 3 fig, 2 tab, 20 ref. CR-807836-01-1.

Descriptors: *Path of pollutants, *Toxic w
*Polychlorinated biphenyls, *Lake Michigan,
ment, Gas chromatography, Water pollution,
atility, Transport, Radioactive dating.

The analysis of sediment core samples from
can serve as an indicator of loading of PCBs
lake system. The work described here indi
that PCB deposition has occured in Lake Mich
since 1928 plus or minus 9 years, and that
PCB accumulation in southern Lake Mich
sediments is about 3400 to 5000 kg. Box c
obtained 9 x 24 x 25.5 cm lake sediment sam
Samples were analyzed for PCBs and dated
Pb-210 dating methodologies. Data on PCB
centrations in core depth profiles are presente
four sampling stations located in south-ce
Lake Michigan. (Halterman-PTT)
W86-02024

ESTIMATING BIOCONCENTRATION POTENTIAL FROM OCTANOL/WATER PARTITION COEFFICIENTS,
Environmental Research Lab.-Duluth, MN.
G. D. Veith, and P. Kosian.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 269-82, 3 fig, 2 tab, 2 ref.

Descriptors: *Path of pollutants, *Toxic wastes, Polychlorinated biphenyls, *Bioconcentration potentials, *Partition coefficients, Model studies, Bioaccumulation, Clorinated hydrocarbons, Fathead minnow, Bluegill, Rainbow trout, Mosquito fish, Coho salmon, Guppy, Flagfish, Spot, Sheepshead minnow, Carp, Channel catfish, Topmouth gudgeon.

A previously derived structure-activity relationship (SAR), which is used to estimate the bioconcentration potential of fish from the n-octanol/water partition coefficient (P), was calculated from data on approximately 50 tests on five general classes of chemicals. That SAR is summarized as: log BCF equals 0.85 log P - 0.70. To assure optimal accuracy in work involving estimating the bioconcentration of potentials, it is useful to determine if the most appropriate SAR is used. This study presents a new SAR, based on over twice as many tests as that previously described. Although the two are slightly different, they predict identical bioconcentration factors (BCF). The authors reviewed 122 tests in order to derive the new SAR, which is summarized as follows: log BCF equals 0.9 log P - 0.40. (Halterman-PTT)
W86-02026

MODEL SIMULATION OF PCB DYNAMICS IN LAKE MICHIGAN,
Paul Univ., Chicago, IL.
W. Rodgers.
: Physical Behavior of PCBs in the Great Lakes, n Arbor Science, Ann Arbor, MI. 1983. p 311-', 4 fig, 4 tab, 16 ref. 807412.

scriptors: *Path of pollutants, *Toxic wastes, olychlorinated biphenyls, *Great Lakes, *Lake chigan, Water pollution, *Model studies, Susded solids, Adsorption, Sediments, Sedimentter interface, Partition coefficients, Mass bale.

he 1970s, the findings of high concentrations of Bs in fish flesh in Lake Michigan led to the d to accurately determine their dynamics in water body. The development of a model of B loadings and the processes which influence r distribtion are detailed. The model was ded using four primary mass balance equations on ds in the water column and sediment layer, and B in the water column and sediment layer. uspension rates, sedimentation rates, and partiing coefficients were also major variables of program. Research is continuing on the use of model for historical trends in PCB loading. rently, the model is appropriate for answering tions of system response to various loading arios, losses and coefficient values. (Halter-PTT)
-02028

NITORING OF PCBS IN WATER, SEDINTS AND BIOTA OF THE GREAT LAKES - IE RECENT EXAMPLES,
rio Ministry of the Environment, Toronto.
Kauss, K. Suns, and A. F. Johnson.
Physical Behavior of PCBs in the Great Lakes, Arbor Science, Ann Arbor, MI. 1983. p 385-11 fig, 4 tab, 11 ref.

riptors: *Toxic wastes, *Polychlorinated biyls, *Great Lakes, *Monitoring, Sediments, ara River, Freshwater clams, Sportfishes, ge fishes, Spottail shiners, Smallmouth bass, w perches, White sucker, Coho salmon, rican eel.

inued monitoring is an important aspect of our rstanding and predictive capabilities regarding s in the Great Lakes region. To this end, the rio Ministry of the Environment monitors PCBs in the waters, sediments and biota of the Great Lakes. Examples of the monitoring programs and some of the results are presented. Lake and river water, sediments, industrial and municipal inputs, suspended sediments, freshwater clams, sportfish and forage fish were sampled and analyzed. PCB concentrations in bottom sediments of the Niagara River sampled in 1979 ranged from non-detectable to 2700 micrograms per kilogram. Raw water sampled downstream of known sources had the highest PCB concentrations. PCB levels in migratory fish were not useful for pinpointing PCB sources. Young-of-the-year spottail shiners collected near specific sites thought to be sources, exhibited high PCB concentrations. Also, clams collected near certain sources had elevated levels of PCBs. (Halterman-PTT)
W86-02030

SIMULATED PRECIPITATION REFERENCE MATERIALS, IV,
National Bureau of Standards (NML), Gaithersburg, MD.
W. F. Koch, G. Marinenko, and J. W. Stolz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139378, Price codes: A02 in paper copy, A01 in microfiche. Report NBSIR 82-2581, June 1982. 17p, 12 tab, 10 ref. AD-13-F-2-535-0.

Descriptors: *Pollutant identification, *Water analysis, *Acid rain, Precipitation, Hydrogen ion concentration, Acidity, Precipitation, Standards, Chemical analysis, Trace elements, Conductance.

A fourth series of simulated precipitation reference material was characterized. Stability of samples from the first three series of simulated precipitation was evaluated. These samples, stored in glass ampoules, were not stable with respect to pH, conductance, acidity, alkali metals, and several of the transition elements. It was recommended that future sample series be divided--one set simulating the major components (mineral acids, alkali salts, and alkaline earth salts) and the other, stabilized with nitric acid, simulating the trace elements. All samples should be stored in clean polyethylene bottles. Variations in pH measurements using different electrodes indicated that this protocol needs revision. An interim pH measurement method is described. Determination of acidity by titrating to a fixed pH endpoint was not accurate enough for acid rain analysis. Preferred techniques are titration to an inflection point (or multiple inflection points for mixed acid systems) or the Gran method. (Cassar-PTT)
W86-02040

BROAD-SPECTRUM ANALYSIS OF THE REMOVAL OF TRACE ORGANICS IN AN OZONE-GRANULAR ACTIVATED CARBON POTABLE-WATER PILOT PLANT STUDY,
Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
For primary bibliographic entry see Field 5B.
W86-02165

ANALYSIS OF ORGANIC COMPOUNDS ADSORBED ON GRANULAR ACTIVATED CARBON FILTERS USED IN TREATMENT PLANTS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. S. Millington, D. J. Bertino, T. Kamei, and R. F. Christman.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 445-454, 4 fig, 1 tab, 8 ref. CR808551.

Descriptors: *Pollutant identification, *Water treatment, *Activated carbon, *Organic compounds, Gas chromatography, Mass spectrometry, Extraction, Sample preparation, Filters, Solvents, Chromatography.

Solvent extraction with Soxhlet apparatus, solvent extraction with ultrasonic agitation, and thermal desorption were compared in desorbing organic matter in carbon samples from water treatment plants. Preliminary results indicated that thermal desorption was least time-consuming and gave a clearer picture of the early eluting components. However, some problems concerning the apparent loss of the high-boiling compounds and the possibility of thermal changes in composition warrant further study. Of the two extraction methods, ultransonic agitation seemed simpler, faster, and less error-prone. About 60 compounds or groups of compounds were identified. Many of these identifications have not been confirmed by comparison with authentic compounds. (Cassar-PTT)
W86-02166

NEW APPROACHES TO THE PRODUCTION OF 36 CL-LABELED CHLORINATING AGENTS AND THE MEASUREMENT OF 36CL INCORPORATED INTO BIOLOGICAL MATERIALS,
Florida Univ., Gainesville. Dept. of Food Science and Human Nutrition.
H. A. Ghanbari, W. B. Wheeler, and J. R. Kirk.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 543-553, 4 fig, 1 tab, 14 ref. PFR 78-27067.

Descriptors: *Fate of pollutants, *Chlorine, *Radioactive tracers, Tracers, Chlorine dioxide, Hypochlorous acid.

Cl36-labeled hydrochloric acid was used to produce two labeled radioactive tracers for use in studying the fate of chlorine: (1) Cl36-labeled hypochlorous acid by potassium permanganate oxidation at a yield of 80% and (2) Cl36-labeled chlorine dioxide by an electrolytic process at 43% yield. A biological material pyrohydrolyzer was developed to prepare samples for chlorine analysis while retaining 99% of the introduced radioactivity. (Cassar-PTT)
W86-02172

ANALYSIS OF ORGANIC N-CHLORAMINES,
Old Dominion Univ., Norfolk, VA. Dept. of Chemical Sciences.
F. E. Scully, J. P. Yang, M. A. Bempong, and F. B. Daniel.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 555-561, 2 fig, 1 tab, 7 ref. CR807254-01.

Descriptors: *Pollutant identification, *Chloramines, *Water analysis, 5-Dimethylamino-1-naphthalenesulfinic acid, Chromatography.

Identification of N-chloramines in chlorinated water systems has been performed using a newly synthesized aromatic sulfinic acid (5-dimethylamino-1-naphthalenesulfinic acid monohydrate). This compound reacts with the chloramines to produce highly fluorescent dansyl derivatives. To detect chloramines at molar concentrations of 10 to the minus 6 power to 10 to the minus 4 power, the reagents are added to a test tube in the following order: 42 mg of sodium bicarbonate, 1 ml of chloramine solution, 1 ml acetonitrile, 100 microliters of 0.1 M solution of the sulfinic acid compound in 0.5M sodium bicarbonate, and 2 drops of 1M sodium hydroxide. The reagents are mixed, and the tube is sealed and placed in the dark for 3 hours. After extraction with chloroform, the product is concentrated for analysis by high performance liquid chromatography. Derivatives of chlorine and the following compounds have been studied: ammonia, aniline, sec-butylamine, ethylenediamine, piperidine, L-leucine. For N-chloropiperidine, the lower limit of detectability is about 10 ng. The fluorescence of the sulfinic acid derivatives is directly proportional to the original concentration of the underivatized N-chloramine. (Cassar-PTT)
W86-02173

NEW METHODS FOR GAS CHROMATOGRAPHIC ANALYSIS OF WATER POLLUTANTS,
Radian Corp., Austin, TX.

L. H. Keith, R. C. Hall, R. C. Hanisch, J. E. Henderson, and R. G. Landolt.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 563-582, 16 fig, 2 tab, 5 ref. 68-03-2965.

Descriptors: *Pollutant identification, *Chromatography, Gas chromatography, Chlorinated hydrocarbons, Organic compounds, Pesticides, Trihalomethanes, Acetonitriles, Polychlorinated biphenyls, Haloacetonitriles.

Two enhancements of gas chromatographic analysis for aquatic pollutants are described: the thermally modulated electron-capture detector (TMECD) and two-dimensional gas chromatography. The TMECD consists of two electron-capture detectors separated by a temperature-controlled pyrolysis unit. It relies on the differences before and after pyrolysis to produce a peak area ratio. Pyrolysis can affect signals in three ways--enhancement, diminishing, or no change--depending on the compound. With the two-dimensional system (post-detector-peak recycling) a sample is chromatographed on one column; the peaks of interest are trapped and thermally desorbed onto a second column, which differs from the first column. The compound can be identified using two retention times. These methods are applied to mixtures of haloacetonitriles and trihalomethanes in drinking water. The TMECD system is also applicable to mixtures of chlorinated hydrocarbon pesticides, polychlorinated biphenyls, and phthalate esters. (Cassar-PTT)
W86-02174

NEW DEVELOPMENTS IN DYNAMIC HEADSPACE ANALYSIS OF HALOGENATED ORGANICS,
A. R. Trussell, J. G. Moncur, F-Y. Lieu, R. R. Clark, and L. Y. Leong.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 583-592, 5 fig, 1 tab, 11 ref.

Descriptors: *Pollutant identification, *Chromatography, *Water analysis, *Organic compounds, Chlorinated hydrocarbons, Pesticides, Insecticides, Aromatic compounds, Capillary columns, Purge and trap procedures.

Use of capillary columns in the purge and trap technique for analysis of halogenated organics in environmental samples has improved quality assurance with capillary resolution. In addition the following advantages were shown: (1) Minimum detection limits for halogenated organics are in the low nanogram-per-liter range. (2) The purge-desorb-analyze procedure allows processing of two samples per hour. (3) The range of recovered compounds has been extended to include organics with boiling points as high as 300 degrees C, for example, dichlorobenzenes, trichlorobenzenes, hexachloroethane, hexachlorocyclopentadiene, hexachlorobutadiene, chlorinated naphthalenes, and chlorinated biphenyls. (4) The fused silica capillary column used in the volatile analysis is coated with liquid-phase SE-54, which also resolves other extractable chlorinated organics and pesticides. This allows simultaneous analysis of volatile and extractable chlorinated organics. (Cassar-PTT)
W86-02175

GAS CHROMATOGRAPHIC ANALYSIS OF PURGEABLE HALOCARBON AND AROMATIC COMPOUNDS IN DRINKING WATER USING TWO DETECTORS IN SERIES,
SRI International, Menlo Park, CA.
B. A. Kingsley, C. Gin, D. M. Coulson, and R. F. Thomas.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 593-608, 6 fig, 2 tab, 7 ref. 68-03-3031.

Descriptors: *Pollutant identification, *Water analysis, *Chromatography, *Organic compounds, Chlorinated hydrocarbons, Trihalomethanes, *Gas chromatography, Aromatic compounds.

Water samples were monitored for both halocarbons and aromatic compounds in a single analysis, using serially connected photoionization detection and electrolytic conductivity detection. This allowed resolution of many identification problems caused by coeluting compounds. The following advantages were demonstrated. (1) Greater sensitivity is obtained than can be obtained by effluent splitting. (2) More information is provided by the simultaneous analysis than by use of either analysis separately. Misidentification of benzene in samples containing trichloroethylene is eliminated. (3) The ability to confirm halocarbon contaminants in trihalomethane-containing water is greatly increased. (4) Analysis time and instrument costs are reduced because one gas chromography performs the work of two. (Cassar-PTT)
W86-02176

REVIEW OF ANALYTICAL METHODS FOR REACTIVE OXIDANT SPECIES IN CHLORINATED WATERS,
Oak Ridge National Lab., TN.
R. L. Jolley, and J. H. Carpenter.
IN: Water Chlorination: Environmental Impact and Health Effects: Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 611-652, 9 tab, 76 ref.

Descriptors: *Pollutant identification, *Literature reviews, *Water analysis, *Chlorine, Oxidation, Chemical analysis, Potentiometers, Amperometry, Colorimetry, Spectrophotometry, Chemiluminescence, Titrimetry, Seawater, Chloramines, Wastewater analysis.

The literature concerning analytical methods for active chlorine-containing species in water has been reviewed. A table summarizes the principal techniques currently in use, their applicability, and the lower limits of detection. These methods are potentiometry, spectrophotometry, colorimetry (8 specific methods listed), chemiluminescence, and titrimetry (4 specific methods listed). With currently available data, selection of a method most suitable for a particular water sample is difficult. EPA-recommended methods for chlorine in water are iodometric titration, DPD (N,N-diethyl-p-phenylenediamine)-colorimetric, or DPD-titrimetric. Specific methods are discussed for the following types of samples: natural and treated waters, polluted waters (which often have unsatisfied chlorine demand), and seawater. Criteria are given for making judgments on reported concentrations of chlorine or oxidants: water quality, analyst expertise, methodology, and statistical significance. Problems of detecting oxidants in the trace and parts-per-billion range are discussed. (Cassar-PTT)
W86-02177

CHLORINE ANALYSIS: PERSPECTIVES FOR COMPLIANCE MONITORING,
Public Service Electric and Gas Co., Newark, NJ.
R. Sugam.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 653-666, 1 fig, 5 tab, 11 ref.

Descriptors: *Pollutant identification, *Water analysis, *Chlorine, Oxidation, Residual chlorine, Monitoring, Amperometry, Titration, Seawater, Brackish water, Chlorine flux monitor.

Several methods for total residual chlorine analysis were evaluated in the field at fresh water, brackish water, and seawater sites. Methods included manual amperometric titration, automatic amperometric titration, amperometric back-titration, and chlorine flux monitor. Two amperometric (forward) titration methods (manual and automatic) were recommended as the best methods for low-level chlorine analysis. Under optimum conditions they can be used accurately and precisely to levels as low as 0.030 (manual) and 0.016 (automatic) mg/liter chlorine. Relative precision (95% confidence level) over a range of at least 1.0 mg/liter was +20%, -17% for the manual method and +30%, -23% for the automatic method. Cost of instrumentation for the manual method is considerably but endpoint detection is easier with autom titration. Analytical precision was poorest at seawater site, reflecting the more rapid decay brominated oxidants compared with chlorin analogs. The chlorine flux monitor recovered oxidant than the other methods at the brac water and seawater sites. It was not suitabl levels below 0.016 mg/liter. Back-titration re ered slightly less oxidant than forward titrat Amperometric back-titration was not suitable levels less than 0.061 mg/liter; it was too com for routine use. (Cassar-PTT)
W86-02178

EXPERIENCE WITH AMPEROMETRIC TRATIONS FOR TOTAL CHLORINE IN T MICROGRAMS-PER-LITER RANGE: LIMI TIONS TO ACCURACY,
Maryland Univ., College Park. Dept. of Che try.
G. R. Helz, D. A. Jaworske, and L. Kosak-Channing.
IN: Water Chlorination: Environmental Imp and Health Effects; Volume 4, Book 1: Chemi and Water Treatment, Ann Arbor Science, Arbor, MI. 1983. p 667-680, 5 fig, 1 tab, 19

Descriptors: *Pollutant identification, *Water a ysis, *Chlorine, *Amperometry, Iodine, Brom Oxidation, Trace levels, Accuracy, Residual c rine, Errors, Iodates, Chemical analysis.

Chemical factors which limit accuracy of amp metric titration of chlorine-produced oxidant natural water are related to iodine chemistry. tors affecting accuracy (systematic errors) incl additive errors (interferences from natural oxi ing agents such as oxygen or iodate ion, collo manganese tetrahydroxide, and reagent impurit and multiplicative errors (volatilization of iodin other oxidant species during determination). In water the disproportionation of iodine to f iodate can cause systematic underdeterminatio chlorine-produced oxidants by a factor of 3 more. The apparent rapid oxidation loss du analysis of free bromine is not caused primaril volatilization, but by formation of iodate. S precautions for minimizing the effect of system error on a result include (1) avoiding the mi order, (sample + buffer) + iodide, (2) using standard additions method with a minimum of additions, and (3) monitoring unchlorinated in water for interferences. (Cassar-PTT)
W86-02179

SENSITIVE, SIMPLE DETERMINATION OXIDANTS IN CHLORINATED WATERS,
Rosenstiel School of Marine and Atmospheric ence, Miami, FL.
J. H. Carpenter, R. G. Zika, and C. A. Moore.
IN: Water Chlorination: Environmental Imp and Health Effects; Volume 4, Book 1: Chemi and Water Treatment, Ann Arbor Science, Arbor, MI. 1983. p 681-697, 9 fig, 14 ref.

Descriptors: *Pollutant identification, *Water a ysis, *Rhodamine B, *Fluorescence, *Chlor Oxidation, Bromine, Trihalomethanes, Orga compounds, Hypobromous acid.

The use of rhodamine B, a fluorescent compou was explored in a method for determining c rine-produced oxidant in water. The reaction hypobromous acid with rhodamine B was stu by adding increments of hypobromus acid to dye at pH 4 and a seawater bromide ion concen tion. The predominant species was molecular b mine. Fluorescence decreased in direct propor to the amount of added hypobromous acid. H ever, at concentrations lower than 0.004 ppm c rine equivalent the reaction of rhodamine B w hypobromous acid appeared to change charac Different ranges of chlorine equivalent were h dled by using four aliquots of sample and add different amounts of rhodamine B, correspond to 0.02, 0.10, 0.50, and 2.00 mg/liter chlo equivalent. Different responses of rhodamine were noted at pH 4 and pH 8. Four analyti classes were considered for differentiation:

chlorine, free bromine, combined chlorine, and combined bromine. Fluorescence decreases at pH 8 were greatest with HOBr, followed by HOCl, NHBr2, and NH2Cl. (Cassar-PTT)
W86-02180

MEASUREMENT OF RESIDUAL CHLORINE COMPOUNDS IN WASTEWATER WITH AMPEROMETRIC MEMBRANE ELECTRODES,
Xertex Corp., Hauppauge, NY.
. W. Stanley, and R. Nossel.
N: Water Chlorination: Environmental Impact nd Health Effects; Volume 4, Book 1: Chemistry nd Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 699-715, 11 fig, 2 tab, 13 ref.

Descriptors: *Pollutant identification, Wastewater analysis, *Chlorine, *Chloramines, esidual chlorine, Amperometry, Electrodes, lembranes.

he 82125 total residual chlorine analyzer meas-es molecular iodine liberated by oxidation of ide by reproducing existing accepted methodol-gy, but with limited selectivity for active ammo-a chloramines. An added feature is minimal elec-ode fouling for low-maintenance operation. The embrane electrode and accompanying reagent dition system is suitable for quantitative and ntinuous measurement of total residual chlorine domestic and light industrial wastewaters. The 125 CAC (chloramine) analyzer incorporates ide in a supporting internal electrolyte and easures triiodide ion liberated by membrane-per-able halogen species. This current response is oportional to the active ammonia chloramine ction of the measured residual and is independ-t of pH (5-8.5) and temperature (5-25 degrees C). served current sensitivities indicate that the nimum detection limits for the membrane elec-de designs are about 0.022 mg/liter as chlorine d 0.092 mg/liter as chlorine for the total residual lorine and chloramine designs respectively. uthor)
86-02181

MULTANEOUS KINETIC ANALYSIS OF LORINE AND CHLORAMINE IN AQUE-S SOLUTION AT MICROMOLAR CON-NTRATION LEVELS,
rtford Univ., West Hartford, CT. Dept. of emistry.
T. Gray, and H. J. Workman.
Water Chlorination: Environmental Impact Health Effects; Volume 4, Book 1: Chemistry Water Treatment, Ann Arbor Science, Ann or, MI. 1983. p 723-731, 3 fig, 6 ref.

scriptors: *Pollutant identification, *Water anal-; *Chlorine, Simultaneous kinetic analysis, -diethyl-p-phenylenediamine, Chloramines, Io-es.

imultaneous kinetic method of analysis for free combined chlorine-containing compounds is ible when using N,N-diethyl-p-phenylenedia-e (DPD) with an iodide catalyst. The sensitivi-f 1-2 micromoles is limited by the cell path th and the molar absorptivity of the oxidized D. Further investigations are aimed toward ering the detection limit of this technique to nanomolar levels by varying the primary re-ng agent. (Author)
-02182

ROVED DETERMINATION OF TOTAL IDUAL CHLORINE AT LOW (MICRO-M-PER-LITER) CONCENTRATIONS IN URAL WATERS,
York State Office of Public Health, Albany. er for Labs. and Research.
anelli, and S. O. Quinn.
Water Chlorination: Environmental Impact Health Effects; Volume 4, Book 1: Chemistry Water Treatment, Ann Arbor Science, Ann r, MI. 1983. p 733-741, 1 fig, 4 tab, 9 ref.

riptors: *Pollutant identification, *Water anal-*Chlorine, N,N-Diethyl-p-phenylenediamine, rimetry, Residual chlorine, Trace levels.

The N,N-diethyl-p-phenylenediamine (DPD) method combined with preliminary ethyl acetate extraction produces a simple, rapid colorimetric field method for determining total residual chlorine at a detection limit of less than 5 micrograms/liter chlorine. The method involves reduction of free or combined chlorine with an excess of potassium iodide at pH 4.7. The triiodide ion prepared is extracted with ethyl acetate and reacted with aqueous DPD reagents. The reaction product is then extracted into the water phase and measured spectrophotometrically at 515 nm. The ethyl acetate removes interferences from turbidity-causing substances such as insoluble carbonates, silicates, metal oxides, manganese dioxide, and plankton. (Cassar-PTT)
W86-02183

FLOW-STREAM DETERMINATION OF CHLORINE SPECIES WITH AN OXYGEN AMPEROMETRIC DETECTOR,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
J. T. Coburn, J. B. Kafil, K. G. Schick, and C. O. Huber.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 743-750, 5 fig, 5 ref. 1435.

Descriptors: *Pollutant identification, *Water analysis, *Chlorine, *Chloramines, Amperometry, Hydrogen peroxide, Iodides, Electrodes, Trace levels.

A technique for rapid, direct, and sensitive determination of specific chlorine species below parts-per-million levels depends on the catalytic effect of iodide to separate chlorine species reacting in the following order: HOCl>NH2Cl>NHCl2. Iodide and hydrogen peroxide are added as individual streams to the sample. The detector consists of a Teflon membrane-covered circular, planar platinum electrode with an internal silver-silver chloride reference electrode. Limits of detection as mg/liter chlorine are as follows: HOCl, 0.008; NH2Cl, 0.08; and NHCl2, 0.2. Since monochlorinated amino acids react similarly to monochloramine, these compounds cannot be separately identified. (Cassar-PTT)
W86-02184

HYPOCHLORITE AND MONOCHLORAMINE DETERMINATIONS USING THE SILVER IODIDE VOLTAMMETRIC ELECTRODE,
Wisconsin Univ.-Milwaukee. Dept. of Chemistry.
T. N. Morrison, A. N. Tsausis, and C. O. Huber.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 751-759, 4 fig, 1 tab, 3 ref. 1435.

Descriptors: *Pollutant identification, *Water analysis, *Chlorine, Trace levels, Chloramines, Voltammetry, Hypochlorite, Monochloramine.

Silver iodide as a voltammetric electrode material provides for useful new chlorine species analytical methods. Configuration of the electrodes and nature of the applied potentials can be selected to optimize the measurements. Major advantages of the silver iodide electrode methods are: no reagents are required, data are rapidly accumulated, it is amenable to flow injection techniques, low (parts-per-billion) limits of detection are possible, the circuitry is relatively simple, and electrodes are easily prepared and maintained. A disadvantage of the silver iodide electrode is that no response has been observed for dichloramine at pH 7-8. This deficiency is somewhat offset by the instability of dichloramine at this pH. (Author)
W86-02185

POTENTIOMETRIC TOTAL RESIDUAL CHLORINE ANALYSIS IN A CONTINUOUS-FLOW SYSTEM,
G. Scarano, M. G. Saroglia, and V. Festa.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 761-772, 8 fig, 2 tab, 9 ref.

Descriptors: *Pollutant identification, *Water analysis, *Chlorine, Electrodes, Oxidation, Seawater, Residual chlorine, Orion 97-70 electrode, Monitoring, Potentiometry.

The Orion 97-70 electrode is a rapid, simple means for continuous determination of low-level total residual oxidant in fresh water and seawater. The electrode responds rapidly enough for use in automated flow analysis. The sensor consists of a platinum redox electrode that develops a potential based on relative levels of iodine and iodide ions in solution and an iodide-ion selective electrode that develops a potential based exclusively on the iodide level in solution. The difference in these two potentials is related to the iodine concentration present in solution that is equal to the total residual oxidant concentration after reaction with the iodide reagent in a pH 4 acetate buffer solution. The accuracy and precision compare with those of the amperometric titration method. Since this sensor is not specific for chlorine, bromine oxidants are also included in the determination. The method is usable over a total residual oxidant range of 0.005 to 1 mg/liter. (Cassar-PTT)
W86-02186

MONITORING TOTAL RESIDUAL CHLORINE BY POTENTIOMETRIC ANALYSIS,
ORION Research, Inc., Cambridge, MA.
J. Soderberg, and J. Synnott.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 773-788, 7 fig, 2 tab, 12 ref.

Descriptors: *Pollutant identification, *Water analysis, *Wastewater analysis, *Chlorine, Oxidation, Potentiometers, Monitoring, Amperometry, Seawater, Cooling water.

Total residual chlorine was measured in five types of water samples by potentiometric and amperometric methods. The samples included cooling water, treated industrial waste from organic industries, treated industrial waste from inorganic industries, treated industrial waste from aluminum industries, and combined domestic/industrial/storm water treated waste. Excellent correlation between the two methods was obtained for all samples at the low part-per-billion level. The potentiometric method compared with the N,N-diethyl-p-phenylenediamine method in a drinking water sample also gave excellent correlation. A commercially available chlorine monitor performed satisfactorily in the field in three situations: river cooling water, treated municipal wastewater, and saline cooling water. (Cassar-PTT)
W86-02187

ENVIRONMENTAL 'TERMITE' INSPECTIONS,
W. A. Duvel.
IN: Hazardous Waste Management for the 80's, Ann Arbor Sciences, Ann Arbor, MI, 1982. p 143-162, 1 fig, 1 tab, 2 exhibits.

Descriptors: *On-site investigations, *Environment, *Pollutants, Economic aspects, Field tests, Groundwater, Water quality, Financial feasibility.

The Environmental Termite Inspection is a new term being applied to site evaluations conducted in relation to commercial and industrial real estate transactions. The inspection usually entails a source characterization, evaluation of hydrogeologic conditions, development of a site map, a detailed site reconnaissance, some subsurface exploration, some evaluation of the population potentially exposed, and a summary risk assessment. The importance of considering water features of the land is stressed, and techniques for non-invasive and invasive subsurface exploration are described. These techniques can include ground surface radar (for determining groundwater depth), resistivity testing, radioactivity detection, organic vapor detection, and analyses of water, soil, waste, and sludge samples. The inspection looks at what hazardous materials are present on the parcel of land; what pathways might serve as conduits for off-site migration; what population is exposed to these

materials; and what adverse conditions could result from this exposure. The cost of such investigations is considered, and the level of investigation required is discussed in relation to the proposed use of the land. (Halterman-PTT)
W86-02223

CHLORINATED DIOXINS AND DIBENZOFURANS IN THE TOTAL ENVIRONMENT,
Butterworth Publishers, Boston. 1983. Edited by G. Choudhary, L. H. Keith, and C. Rappe. 416 p.

*Chlorinated hydrocarbons, *Hydrocarbons, *Chlorinated dioxins, *Chlorinated dibenzofurans, Chemical analysis, Gas chromatography, Chromatography, Mass spectrometry, Public health, Ecosystems, Ecology.

The growing concern for the health hazards of exposure to chlorinated dioxins and dibenzofurans in the total environment led to a symposium held in conjunction with the national meetings of the American Chemical Society. The topics covered include chemical characterization, environmental transport, residues in Great Lakes, breakdown products, levels in wastewater, levels in environmental samples, analytical procedures, and occupational exposures and effects. (Halterman-PTT)
W86-02233

2,3,7,8-TETRACHLORODIBENZO-P-DOXIN AND 2,3,7,8-TETRACHLORODIBENZOFURAN RESIDUES IN GREAT LAKES COMMERCIAL AND SPORT FISH,
Health and Welfare Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W86-02234

DETERMINATION OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN INDUSTRIAL AND MUNICIPAL WASTEWATERS, METHOD 613: DEVELOPMENT AND DETECTION LIMITS,
California Analytical Labs., Inc., Sacramento.
A. S. Wong, M. W. Orbanosky, P. A. Taylor, C. R. McMillan, and R. W. Noble.
IN: Chlorinated Dioxins and Dibenzofurans in the Total Environment, Butterworth Publishers, Boston, 1983. p 165-192, 9 fig, 1 tab, 4 ref.

Descriptors: *Chlorinated hydrocarbons, *Hydrocarbons, Chlorinated dioxins, Chemical analysis, Gas chromatography, Chromatography, Public health, Regulations.

As a result of public comment and recent advances in analytical procedures, the standard method of determination of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-tetra-CDD) recognized by the EPA has been developed. The final version of the procedure is typical of the methodologies developed for other priority pollutants requiring solvent extractables, except that the labelled internal standard is added to every sample. The aqueous sample is extracted with methylene chloride, which is then exchanged to hexane, which is then washed with 10 N NaOH and concentrated sulfuric acid, to remove acidic and basic co-extracts and any neutral compounds that react easily with concentrated sulfuric acid. The assay step is performed using a capillary column that gives a unique isomer-specific separation for 2,3,7,8-tetra-CDD and is coupled to an MS detector operating in the SIM mode. Criteria for qualitative confirmation are that the GC column be isomer-specific; all 2,3,7,8-tetra-CDD (native and internal standard) coelute; the chlorine isotope ratio is within 10% of the calibration standard; and all peaks are greater than 2.5 times the noise level. (Halterman-PTT)
W86-02235

OCCURRENCE OF TETRACHLORODIBENZO-P-DIOXIN IN ENVIRONMENTAL SAMPLES FROM SOUTHWEST MISSOURI,
Environmental Protection Agency, Kansas City, MO. Region VII.
R. D. Kleopfer, W. W. Bunn, K. T. Yue, and D. J. Harris.
IN: Chlorinated Dioxins and Dibenzofurans in the Total Environment, Butterworth Publishers, Boston. 1983. p 193-201, 1 fig, 2 tab, 9 ref.

Descriptors: *Chlorinated hydrocarbons, *Water pollution, *Missouri, *Hydrocarbons, *Chlorinated dioxins, Chemical analysis, Gas chromatography, Public health, Ecosystems, Ecology, Fish.

Following the discovery of illegally disposed tetrachlorodibenzo-p-dioxin (tetra-CDD) in southwest Missouri, a series of investigations has been conducted to determine the extent of contamination in the area. Water, fish, soil, sediments and air samples were analyzed. The highest levels ranged from 33,000 to 343,000 ppb, found in storage tanks and a contaminated horse arena. The highest levels in fish were found in suckers, ranging from 5 to 55 ng/kg. The highest levels found in fish were from specimens collected from the area where the highest sediment levels were observed. Although clean-up efforts are underway, investigations and monitoring of the problems are expected to continue for several years to come. (Halterman-PTT)
W86-02236

COMPOSITION OF POLYCHLORINATED DIBENZOFURAN AND DIBENZO-P-DIOXIN RESIDUES IN SEDIMENTS OF THE HUDSON AND HOUSATONIC RIVERS,
Columbia National Fisheries Research Lab., MO.
J. D. Petty, L. M. Smith, P-A. Bergqvist, J. L. Johnson, and D. L. Stalling.
IN: Chlorinated Dioxins and Dibenzofurans in the Total Environment, Butterworth Publishers, Boston, 1983. p 203-207, 3 tab, 12 ref.

Descriptors: *Chlorinated hydrocarbons, *Hydrocarbons, *Chlorinated dioxins, *Chlorinated dibenzofurans, Chemical analysis, Gas chromatography, Chromatography, Mass spectrometry, Public health, Ecosystems, Ecology, Fish, Sediments.

The methodologies and results of analysis of sediment and fish samples, from the Hudson and Housatonic Rivers, for polychlorinated dibenzofuran and dibenzo-p-dioxin (PCDF and PCDD, respectively) are outlined. The variable results obtained indicate the need for additional work in this area. The samples contained both compounds, primarily the higher-chlorinated congeners. The hepta- and octa-congeners predominated in sediments and tetra- and penta-congeners predominated in fish. Insufficient evidence exists to determine the differences between the profiles in fish and sediments. (Halterman-PTT)
W86-02237

NEW GAS CHROMATOGRAPHIC DETECTOR FOR TETRACHLORODIBENZO-P-DIOXIN AND TETRACHLORODIBENZOBURAN ANALYSES,
Radian Corp., Austin, TX.
L. H. Keith, L. D. Ogle, A. E. Jones, R. C. Hanisch, and R. C. Hall.
IN: Chlorinated Dioxins and Dibenzofurans in the Total Environment, Butterworth Publishers, Boston. 1983. p 239-257, 12 fig, 8 tab, 4 ref.

Descriptors: *Chlorinated hydrocarbons, *Hydrocarbons, *Chlorinated dioxins, *Chlorinated dibenzofurans, Chemical analysis, Gas chromatography, Chromatography, Mass spectrometry, Public health, Ecosystems, Ecology.

Gas chromatography and a new prototype detector, a thermally modulated electron-capture detector (TMECD) appear to offer a unique new method for screening for tetrachlorodibenzo-p-dioxin and tetrachlorodibenzofuran at trace levels in complex samples. A great benefit of this method is its high sensitivity to most pollutants of interest. The lower limit of detection for these samples was about 1 ppb. The technique can be used to analyze tissues, fly ash, soil, water and transformer oils. It has the potential to save large sums of money because samples can be screened, and negative samples can be eliminated from costly mass spectrometry analyses. (Halterman-PTT)
W86-02238

VALIDATION STUDY FOR THE GAS CHROMATOGRAPHY/ATMOSPHERIC PRESSURE IONIZATION/MASS SPECTROME
METHOD FOR ISOMER-SPECIFIC DETER
NATION OF 2,3,7,8-TETRACHLORO
BENZO-P-DIOXIN,
National Center for Toxicological Research, ferson, AR.
R. K. Mitchum, W. A. Korfmacher, and G. F. Moler.
IN: Chlorinated Dioxins and Dibenzofurans in Total Environment, Butterworth Publis Boston. 1983. p 273-286, 7 fig, 6 tab, 18 ref.

Descriptors: *Chlorinated hydrocarbons, *Hy carbons, *Chlorinated dioxins, *Chlorinated di zofurans, Chemical analysis, Gas chromatogra Chromatography, Mass spectrometry, Pu health, Ecosystems, Ecology.

Following the increased need for an isomer-sp ic method for 2,3,7,8-tetrachlorodibenzo-p-di (2,3,7,8-tetra-CDD) determinations, new labo ry and analytical techniques have been develo The apparatus, reagents, sample clean-up pr dures, homogenization, digestion, extraction, HPLC, reverse-phase HPLC, sample quanti tion, recovery experiments, and a series of va tion experiments are described. The validatio periments have been successful in identifying quantifying these compounds. (Halterman-PT W86-02239

CHLORINATED DIOXINS AND DIBEN
FURANS IN THE TOTAL ENVIRONMENT
Butterworth Publishers, Boston. 1985. Edite Lawrence H. Keith, Christopher Rappe, and gadhar Choudhary. 547 p.

Descriptors: *Chlorinated hydrocarbons, *Hy carbons, *Aquatic environment, *Water anal *Chemical analysis, *Fish, *Aquatic insects, logical magnification, Ecosystems, Polychlorin dibenzo-p-dioxin, 2,3,7,8-tetrachlorodibenz dioxin, Polychlorinated dibenzofuran.

Current research on various aspects of the tamination of the total environment (air, w soil) with chlorinated dioxins and dibenzofura presented. Discussion topics include synthesis, lation, characterization and destruction of t compounds; the fate and distribution of polych nated dioxins (PCDD) and polychlorinated d benzofurans (PCDF) in the aquatic environ (including analysis of sediment samples, bioav bility to aquatic insects and residues found in the analysis and effects of human exposur PCDD and PCDF; soil sampling and analysis; emission from incineration sources. (Halter PTT)
W86-02240

HISTORICAL RECORD OF POLYCHLO
NATED DIOXINS AND FURANS IN L
HURON SEDIMENTS,
Indiana Univ. at Bloomington. School of P and Environmental Affairs.
J. M. Czuczwa, and R. A. Hites.
IN: Chlorinated Dioxins & Dibenzofurans in Total Environment II, Butterworth Publis Boston, 1985. p 59-63, 2 fig, 11 ref. 80EV-10

Descriptors: *Polychlorinated dibenzo-p-dio *Water pollution sources, *Chlorinated hydro bons, *Hydrocarbons, *Aquatic environment, ychlorinated dibenzofurans, Great Lakes, Huron, Gas chromatography, Mass spectrom Water analysis, Chemical analysis.

Sediment core sampling was used in a study signed to assess the historical input of combust generated polychlorinated dibenzo-p-dio (PCDD) and dibenzofurans (PCDF) into the ronment. The goal of the investigation wa determine whether these compounds (inclu some highly toxic isomers) are formed prim from the pyrolysis of chlorinated aromatic pre sors present in the fuel or are formed during combustion of naturally occurring organic ma als. Four core samples from southern Lake H were extracted with isopropanol followed methylene chloride, and final extracts were lyzed by gas chromatographic mass spectrom

sing methane-negative chemical ionization. This echnique allows determination of PCDD and CDF at low parts per trillion levels. The most bundant species tended to be the highly chlorinat- d PCDD and PCDF, with octachlorodioxin pre- ominating in all samples. There was no evidence f degradation of PCDD or PCDF. Depth vs. oncentration profiles show that the input of these wo compounds increased dramatically in approxi- ately 1940, which corresponds to an increased roduction of chlorinated aromatic compounds, ncluding those used in herbicides and wood pre- rvatives. Thus, combustion of municipal waste is ggested as a major source. It was concluded that e high levels found do not reflect natural com- stion processes, but rather anthropogenic com- stion, primarily combustion of chlorinated pre- rsors present in combustion fuels. (Halterman- TT)
86-02241

NALYSIS OF PCDD-PCDF IN ENVIRON- IENTAL SAMPLES,
epartment of the Environment, Ottawa (Ontar-).
. C. Lao, R. S. Thomas, C. Chiu, and K. Li.
: Chlorinated Dioxins & Dibenzofurans in the otal Environment II, Buttworth Publishers, oston, 1985. p65-78, 7 fig, 6 tab, 11 ref.

escriptors: *Chlorinated hydrocarbons, *Hydro- rbons, *Water pollution sources, *Aquatic envi- nment, *Water analysis, Wastewater, Sludge dis- sal, Industrial wastes, Gas chromatography, ass spectrometry, Polychlorinated dibenzo-diox- , Polychlorinated dibenzofurans, Chemical anal- s, Ecosystems.

veral environmental sources were analyzed for lychlorinated dibenzo-p-dioxins (PCDD) and lychlorinated dibenzofurans (PCDF) in an effort identify more actual or potential PCDD-PCDF thways to the environment. The samples ana- ed were: aquatic discharges from wood preserv- ve plants; influent raw sewage, wastewater ef- ents and exhaust gases from a sludge incinerator; luent gas stream from a coal preparation plant; seous effluent and the cooling water stream from lasma hydrolysis process (a prototype apparatus destruction of organic halide waste); gaseous mples from open-air wire insulation burning; and haust gases from a hospital waste incinerator. alysis was by gas chromatography-mass spec- metry, using the Townsend discharge tech- que. One or more PCDD-PCDF compounds re present in all samples. The concentrations, ent of chlorination and isomeric distributions re notably dependent on the feedstock and de- uction process, and on operational parameters. array of PCDD-PCDF was identified in main luent discharge from the wood preservation nt and was also readily identified at 0.8 km wnstream from the discharge, although at a arkably reduced level. In the sludge-burning mples, the preliminary mass-balance calculations gest that sludge accumulates all the PCDD- DF, and the resultant mass loading to the incin- tor is about 1 gm/day. (Halterman-PTT)
6-02242

TANOL-WATER PARTITION COEFFI- ENT OF 1,3,6,8-TCDD AND OCDD BY RE- RSE PHASE HPLC,
nitoba Univ., Winnipeg. Dept. of Soil Science.
R. B. Webster, L. P. Sarna, and D. C. G. Muir.
Chlorinated Dioxins & Dibenzofurans in the al Environment II, Butterworth Publishers, ton, 1985. p 79-87, 2 fig, 2 tab, 6 ref. OSU 82- 77.

scriptors: *Chlorinated hydrocarbons, *Hydro- bons, *Water pollution sources, *Chemical lysis, *Aquatic environment, Chromatography, achlorodibenzo-p-dioxin, 1,3,6,8-tetrachlorodi- zo-p-dioxin, Water analysis.

enable the environmental dynamics of the orinated dioxins octachloro-dibenzo-p-dioxin DD) and 1,3,6,8-tetrachlorodibenzo-p-dioxin ,6,8-TCDD) to be obtained by simple modeling ulations, key physical properties were deter- mined. The porperties studied were octanol-water partition coefficient and water solubility, since these are closely related to a substance's ability to pass through biological membranes and bioaccumulate or to partition between environmental media. A reversed-phase high-performance liquid chromatography method for determination of these two properties is presented. Since standard methods are not effective with these hydrophobic substances, a modification using a quadratic equation is presented. The data presented indicate that the quadratic-derived values of the log of the octanol-water partition coefficient for both 1,3,6,8-TCDD and OCDD agree with the water solubility-determined values very well. (Halterman-PTT)
W86-02243

BIOAVAILABILITY OF 14C-1,3,6,8-TETRACHLORODIBENZO-P-DIOXIN AND 14C-OCTACHLORODIBENZO-P-DIOXIN TO AQUATIC INSECTS IN SEDIMENT AND WATER,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B.
W86-02244

ANALYSIS OF POLYCHLORINATED DIBENZOFURANS AND DIOXINS IN ECOLOGICAL SAMPLES,
Umea Univ. (Sweden). Dept. of Organic Chemistry.
C. Rappe, P. A. Bergqvist, and S. Marklund.
IN: Chlorinated Dioxins & Dibenzofurans in the Total Environment II, Butterworth Publishers, Boston, 1985. p 125-138, 8 fig, 5 tab, 16 ref.

Descriptors: *Chlorinated hydrocarbons, *Hydrocarbons, *Chemical analysis, *Aquatic environment, Polychlorinated dibenzo-p-dioxin, Polychlorinated dibenzofuran, Gas chromatography, Fish, Herring, Baltic Sea.

The need for a highly sensitive and specific analytical technique for the measurement of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibensofurans (PCDF) is emphasized, and the requirements to be met by such a method are discussed. A recovery study of the cleanup system analyzing fish samples fortified at three different spiking levels using synthetic PCDD and PCDF standard is reported. The PCDF and PCDD were extracted and separated from interfering substances in two series of sequential chromatographic processes. Detection was accomplished by gas chromatography-mass spectrometry. Recoveries of the various isomers at spiking levels of 0, 20 and 100 ppt are reported. In addition, studies on the elution order of the same isomers on an alumina column are presented. Also included are results from analyses of herring and guillemot samples from the Baltic Sea. A series of PCDD and PCDF has been identified in these samples at the ppt level. (Halterman-PTT)
W86-02246

ANALYSIS OF PCBS USING SPECIFIC ISOMER HIGH RESOLUTION CAPILLARY GAS CHROMATOGRAPHY,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
M. D. Mullin, C. Pochini, S. H. Safe, and L. M. Safe.
IN: PCB's: Human and Environmental Hazards, Butterworth Publishers, Boston, 1983. p 165-176, 4 fig, 3 tab, 30 ref.

Descriptors: *Polychlorinated biphenyls, *Public health, *Social aspects, *Chemical analysis, Great Lakes, Political aspects, Water analysis, Monitoring, Toxicity, Fish, Gas chromatography, Chromatography.

The problems associated with the toxicology and analytical chemistry of polychlorinated biphenyls (PCBs) are primarily due to the large numbers of theoretically possible isomers. The toxicity of PCBs is a function of the structure of the individual isomer. It is not sufficient to quantify the total amount of PCBs present in an environmental sample; the concentrations of the isomers which are potentially more toxic must also be determined. High resolution gas chromatographic analytical techniques are outlined and examples of resultant chromatograms are presented. The use of high resolution capillary gas chromatography, in conjunction with the use of PCB isomers as reference standards, is presently a viable analytical technique for the analysis of commerical PCB formulations and environmental samples from many different matrices. (Halterman-PTT)
W86-02254

WATER ANALYSIS, VOLUME 1: INORGANIC SPECIES, PART 1,
Academic Press, Inc., Orlando, FL. 1982. Edited by Roger A. Minear and Lawrence H. Keith. 287 p.

Descriptors: *Water analysis, *Reviews, *Trace elements, *Inorganic compounds, *Theoretical analysis, Organic compounds, Alkalinity, Acidity, Conductance, Dissolved soilds, Oxidation-reduction potential, Turbidity, Water quality, Natural waters, Wastewater analysis.

This volume is the first of three volumes designed to present both the theoretical and the practical aspects of understanding and determining the trace-level components that are found in all natural, pristine, and polluted waters. Volume I is the first of two focusing on the inorganic constituents in water. The first chapter presents a background on the inorganic constituents found in water. A general treatment of the sources of representative species found in both natural waters and wastewaters is followed by a discussion on the effects of hydrolysis, complexation, and dissolution in conjunction with redox and pH in the environmental dynamics of these species. Chapters 2 and 3 include a detailed discussion of these topics. The fourth chapter deals with conductance, a general measure of solution ionic content. The in-depth treatment of light scattering theory principles in Chapter 5 is intended to give the reader a sufficient understanding of the complexity of turbidimetric responses. Chapter 6 concludes the volumen with a survey of general water quality analytical procedures used for measuring individual inorganic species. (Geiger-PTT)
W86-02257

REDOX POTENTIAL: ITS MEASUREMENT AND IMPORTANCE IN WATER SYSTEMS,
Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 2K.
W86-02259

ALKALINITY AND ACIDITY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2K.
W86-02260

CONDUCTANCE: A COLLECTIVE MEASURE OF DISSOLVED IONS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 1B.
W86-02261

THEORY AND MEASUREMENT OF TURBIDITY AND RESIDUE,
Hach Co., Loveland, CO.
For primary bibliographic entry see Field 2K.
W86-02262

SUMMARY OF METHODS FOR WATER-QUALITY ANALYSIS OF SPECIFIC SPECIES,
Geological Survey, Arvada, CO. Water Resources Div.
H. E. Taylor.
IN: Water Analysis, Academic Press, Orlando, FL, 1982, Volume 1: Inorganic Species, Part 1. 1982, p 235-273, 2 fig, 7 tab, 42 ref.

Descriptors: *Water analysis, *Water quality, *Chromatography, *Electrochemistry, *Pollutant identification, *Spectrophotometry, Chemical

properties, Wastewater analysis, Natural waters, Gas chromatography, Conductance, Potentiometers, Mass spectrometry, Photometry, X-ray spectroscopy.

In the past 20 years, a variety of methods have been developed to solve specific analytical water quality problems. Several categories of analysis are available depending on the objective of the application. These are: qualitative, semiquantitative, and quantitative. Most modern methods of instrumental analysis base their quantitation on the method of direct comparison wiih a synthetic standard or a known concentration reference material for standardization. Classical methods are generally considered to be in one of two categories, either gravimetric or volumetric analysis. Usually classical method are not employed in the modern water quality laboratory because of their time requirements. Spectroscopic methods of analysis can be broken down into two major categories - absorption techniques and emission or fluorescence techniques. Molecular and atomic absorption methods are described. Emission methods examined include atomic emission, molecular emission, atomic fluorescence, x-ray fluorescence, neutron activation, and mass spectrometry. Electrochemical methods of water analysis can be grouped into several different categories. They include: potentiometric techniques, voltammetric techniques, amperometry, and conductance techniques. Chromatography is one of the most effectively known methods of separating interfering constituents prior to analysis. The principles of chromatographic analysis are described. (Geiger-PTT)
W86-02263

GEOCHEMICAL IDENTIFICATION OF SALINITY SOURCES,
Kansas State Geological Survey, Lawrence.
D. O. Whittemore.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 505-514, 5 fig, 14 ref.

Descriptors: *Saline water, *Salinity, *Water pollution sources, *Pollutant identification, *Brines, Oil field brines, Chemical analysis, Dissolved solids, Isotope studies, Kansas.

The assessment of the concentrations and ratios of dissolved constituents and isotopes to identify salinity sources is described. For instance, values of Na/Cl weight ratios are 0.5 for oil-field brines in Kansas, and 0.65 for salt-solution brines in near-surface Permian rocks. The significance of ratios of B/Cl, Li/Cl, Br/Cl, and I/Cl are also discussed. Major sources of salinity in Kansas, including near-surface evaporate solutions and oil-field brines, are described. Case histories of salinity source identification are outlined, including those from Smokey Hill River Valley, Great Bend Prairie, Equus Beds, and the Blood Orchard area. (Halterman-PTT)
W86-02309

QUALITY OF GROUND WATER IN THE PRINCIPAL AQUIFERS OF NORTHEASTERN-NORTH CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02345

PRELIMINARY ANALYSIS OF GEOHYDROLOGIC DATA FROM TEST WELLS DRILLED NEAR CHESTER, ON KENT ISLAND, QUEEN ANNES COUNTY, MARYLAND,
Maryland Dept. of Natural Resources, Annapolis.
F. K. Mack.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 82-854, 1983. 31 p, 11 fig, 4 tab, 12 ref.

Descriptors: Groundwater, Geohydrologic units, *Water wells, Coastal Plain, *Water quality, Water temperature, *Aquifer testing, Borehole geophysics, Hydrographs, *Maryland, *Queen Annes County, Kent Island.

A test hole drilled on Kent Island, Queen Annes County, Maryland, to a depth of 2548 feet, penetrated 2518 feet of Coastal Plain sediments and 30 feet of the underlying bedrock. Drill cuttings, cores, and geophysical logs were used to identify five aquifers: the Patuxent, lower Patapsco, upper Patapsco, Magothy, and Aquia. Water samples and pumping test data obtained from wells completed in the aquifers wre used to determine the water quality and transmissivities of the aquifers. Transmissivity of each, in feet squared per day, was found to be >800, 1,400, 4,000, 5,800, and >320 respectively. Chemical analyses showed that water from each aquifer is fresh and is distinctly different in chemical character from the others. Iron exceeded the limit recommended by EPA for drinking water in each of the aquifers. Water in the deeper aquifers is soft but water in the Aquia aquifer has a hardness of 160 milligram/Liter. Water levels in the wells are (1) affected by tidal changes in nearby estuaries of Chesapeake Bay, and (2) are highest in the deepest aquifer (16 feet above sea level) and progressively lower in each of the shallower aquifers. (USGS)
W86-02349

ANALYSIS OF GROUND-WATER-QUALITY DATA IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02361

CHEMICAL AND ISOTOPIC CHARACTERISTICS OF BRINES FROM THREE OIL- AND GAS-PRODUCING FORMATIONS IN EASTERN OHIO, WITH APPLICATIONS TO THE GEOCHEMICAL TRACING OF BRINE SOURCES,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02365

GROUND-WATER QUALITY DATA FOR THE ATLANTIC COASTAL PLAIN: NEW JERSEY, DELAWARE, MARYLAND, VIRGINIA, AND NORTH CAROLINA,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02374

5B. Sources Of Pollution

DATA ON SURFACE-WATER QUALITY AND QUANTITY, TRUCKEE RIVER SYSTEM, NEVADA AND CALIFORNIA, 1979-81,
Geological Survey, Carson City, NV. Water Resources Div.
R. J. La Camera, R. J. Hoffman, J. O. Nowlin, L. H. Smith, and S. M. Lima.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-238, 1985. 191 p, 2 fig, 36 tab, 17 ref.

Descriptors: *Channel morphology, *Synoptic analysis, *Travel time, *Water quality, *Water temperature, Aeration, Dyes, Interstitial water, Phytoplankton, Tracers, *Truckee Canal, *Truckee River, *California, *Nevada.

Selected hydrologic data were collected between May 1979 and October 1981 at 59 sites on the Truckee River, 10 sites on selected tributaries and smaller diversions, and 9 sites on the Truckee Canal. The data were collected in support of the water-quality and hydrologic investigation components of the Truckee-Carson River-Quality Assessment by the U.S. Geological Survey. This report contains data from: (1) diel and antecedent measurements made in conjunction with four synoptic water-quality studies, (2) analyses of phytoplankton samples to supplement other biological data collected during the synoptic studies, (3) an investigation of surface and intragravel water quality to determine the suitability of the river as a spawning habitat for Lahontan cutthroat trout, (4) 10 water-temperature recorders, (5) 11 dye-tracer studies, (6) 5 gas-tracer reaeration studies, (7) summaries of dye-tracer travel times derived from the dye
reaeration studies, and (8) discharge measurem
with associated channel-geometry description
46 miscellaneous sites on the river, selected tri
taries, and the canal. (USGS)
W86-01924

**COMPUTER MODEL OF ONE-DIMENSIO
AL EQUILIBRIUM CONTROLLED SORPTI
PROCESSES,**
Geological Survey, Denver, CO. Water Resour
Div.
D. B. Grove, and K. G. Stollenwerk.
Available from OFSS, USGS Box 25425 La
wood, CO 80225. USGS Water-Resources Inve
gations Report 84-4059, 1984. 58 p, 15 fig, 2 tab
ref.

Descriptors: *Water pollution, *Computer mod
*Mathematical models, Groundwater, Ion tra
port, Ion exchange, Chemical reactions, *Grou
water movement, Sorption processes, *Finite-
ference methods, *Path of pollutants.

A numerical solution to the one-dimensio
solute-transport equation with equilibrium-c
trolled sorption and a first-order irreversible-r
reaction is presented. The computer code is w
ten in FORTRAN language, with a variety
options for input and output for user ease. Sorpt
reactions include Langmuir, Freundlich, and i
exchange, with or without equal valance. Gene
equations describing transport and reaction pr
esses are solved by finite-difference methods, w
nonlinearities accounted for by iteration. Compl
documentation of the code, with examples, is
cluded. (USGS)
W86-01925

**TEST WELL INSTALLATION AND WAT
QUALITY, HOLLYWOOD DUMP AR
MEMPHIS, TENNESSEE,**
Geological Survey, Memphis, TN. Water
sources Div.
D. D. Graham.
Available from OFSS, USGS Box 25425 La
wood, CO 80225. USGS Water-Resources Inve
gations Report 84-4214, 1985. 35 p, 10 fig, 4 tab,
ref.

Descriptors: *Landfills, *Groundwater contami
tion, Aquifers, Water quality, *Tennessee, Me
phis, Waste pollution sources, Path of pollutan

The Hollywood Dump in north Memphis, Tenn
see is known to contain hazardous wastes. Moni
wells were installed and sampled to determine
contaminants have entered the underlying W
River alluvium and concentrated near the base
this unconfined aquifer. Four water-quality sa
ples were collected from each of nine moni
wells screened in the Wolf River alluvium at t
Hollywood Dump between June 1982 and Ju
1983. Also sampled during this period was o
well screened in the fluvial (terrace) depos
about one-half mile upgradient from the dump, a
three nearby wells screened in the Memphis Sa
artesian aquifer. Low levels of several orga
compounds, including heptachlor, chlordane a
chlordene, were detected in water from the W
River alluvium. High concentrations of barium a
arsenic were also detected. Water from the Me
phis Sand showed no traces of synthetic orga
compounds. Other constituents and propert
were found to be at levels that are normal for th
aquifer. Five of the Wolf River alluvium we
sampled were newly installed. Geophysical lo
made in these wells, supplemented by drillers lo
and split spoon samples, show that clay underl
the alluvial aquifer at the well locations. (USG
W86-01928

**GROUND-WATER HYDROLOGY OF VOL
SIA COUNTY, FLORIDA, WITH EMPHAS
ON OCCURRENCE AND MOVEMENT O
BRACKISH WATER,**
Geological Survey, Orlando, FL. Water Resourc
Div.
For primary bibliographic entry see Field 2F.
W86-01932

YDROLOGY OF AREA 11, EASTERN COAL ROVINCE, OHIO, KENTUCKY, AND WEST RGINIA,
eological Survey, Columbus, OH. Water Re-urces Div.
r primary bibliographic entry see Field 2E.
86-01937

CCURRENCE OF SALINE WATER IN THE LLUVIAL AQUIFER IN THE BOEUF-NSAS BASIN, ARKANSAS,
eological Survey, Little Rock, AR. Water Re-urces Div.
J. Fitzpatrick.
ailable from OFSS, USGS Box 25425 Lake-od, CO 80225. USGS Water-Resources Investi-ions Report 85-4029, 1985. 1 sheet, 3 fig, 1 tab, ref.

scriptors: *Groundwater pollution, Water qual- *Saline water intrusion, Aquifers, Groundwat- *Arkansas, Gulf Coastal Plain, Boeuf-Tensas in.

e occurrence of saline water in the alluvial ifer in the Boeuf-Tensas basin in southeastern ansas has been of increasing concern. A band saline water containing chloride concentrations greater than 50 milligrams per liter extends ough the entire length of the basin. The most erely affected area is located in the southern t of the basin where chloride concentrations are igh as 1,360 milligrams per liter. The origin of saline water in the alluvial aquifer is not defi-ly known, but can probably be attributed at t in part, to both upward movement from the ansas River. Upward instrusion of saline und water has probably occurred through one more of the following: 1) leakage where the kson confining unit is thinned or absent, 2) age along a fault, and 3) movement through ndoned oil and gas test holes. (USGS)
6-01940

TROGEN, SULFATE, CHLORIDE, AND NGANESE IN GROUND WATER IN THE LUVIAL DEPOSITS OF THE SOUTH ATTE RIVER VALLEY NEAR GREELEY, LD COUNTY, COLORADO,
logical Survey, Lakewood, CO. Water Re-ces Div.
G. Gaggiani.
ilable from OFSS, USGS Box 25425 Lake-d, CO 80225. USGS Water-Resources Investi-ons Report 84-4088, 1984. 2 sheets, 6 fig, 15 ref.

criptors: *Groundwater pollution, *Alluvial fers, *Water quality, Feedlots, Irrigation ef-s, Groundwater irrigation, Groundwater re-ge, Chlorides, Nitrates, Sulfates, Manganese, lorado, *Cattle wastes, *Valley-fill deposits, th Platte River Valley, Kersey.

und water from the valley-fill deposits of the th Platte River Valley and its tributaries is used nsively for agriculture in the study area, about niles east of Greeley and about 50 miles north-of Denver, Colorado. The valley-fill deposits, ch consist of alluvial and terrace deposits, are valley system eroded in Laramie Formation ock. Water samples collected from 53 wells ng 1974 and 1980 were analyzed for nitrite plus te nitrogen, sulfate, chloride, and manganese. ian concentrations changes in these constitu-from 1974 to 1980 are as follows: 6.0 to 8.8 grams per liter for nitrite plus nitrate nitrogen, to 900 milligrams per liter for sulfate, and 94 to milligrams per liter for chloride. Manganese centrations were greater than 1,000 micro-ns per liter in both 1974 and 1980 in a small at the mouth of Box Elder Creek. (USGS)
-01941

ECTS OF URBANIZATION OF THREE NDS IN MIDDLETON, WISCONSIN,
logical Survey, Madison, WI. Water Re-ces Div.
primary bibliographic entry see Field 4C.
-01949

CHEMICAL QUALITY OF WATER AT 14 SITES NEAR KESTERSON NATIONAL WILDLIFE REFUGE, FRESNO AND MERGED COUNTIES, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
J. A. Izbicki.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-582, 1984. 17 p, 1 fig, 2 tab, 2 ref.

Descriptors: *Irrigation-return flow, *Water pollution sources, trace elements, Trace metals, Water quality, *Kesterson Reservoir, West Side San Joaquin Valley, San Luis Drain, *California, Agricultural drainage.

Data were collected to determine concentrations of major ions, nutrients, and selected trace elements in collector drains tributary to the San Luis Drain; the San Luis Drain near Kesterson Reservoir; Kesterson Reservoir; and selected drains, canals, and sloughs near but not tributary to Kesterson Reservoir, California. Results from 14 samples collected during January 24-26, 1984, are summarized in tables, and the sample locations are shown on maps. (USGS)
W86-01959

SIMULATED EFFECTS OF SURFACE COAL MINING AND AGRICULTURE ON DISSOLVED SOLIDS IN ROSEBUD CREEK, SOUTHEASTERN MONTANA,
R. F. Ferreira.
Available from OFSS, USGS BOX 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4101, 1984. 94 p, 4 fig, 25 tab, 43 ref.

Descriptors: *Coal mines, Strip mines, Dissolved solids, *Water pollution sources, irrigation effects, *Simulation analysis, *Surface mining, Rosebud Creek, *Montana.

Dissolved-solids concentrations in five reaches of Rosebud Creek in southeastern Montana were simulated to assist in evaluating the effects of surface coal mining and agriculture on the dissolved-solids concentration. A mass balance of streamflow and dissolved-solids load was used. Mined acreage, dissolved-solids concentrations in mined spoils, and irrigated acreage were varied in the model to study relative changes in the dissolved-solids concentration of each reach of Rosebud Creek. Both simulated monthly streamflow and dissolved-solids load generally are within the 95-percent confidence limits of the mean monthly values calculated for Rosebud Creek at the mouth near Rosebud, Montana. From May through September, the simulated mean monthly streamflows vary by no more than 15 percent of the historical mean values. Except for January, May, and December, the simulated mean monthly dissolved-solids loads vary by no more than 13 percent of the historical mean values. Simulations based on present mining show irrigation accounting for a larger cumulative percentage of dissolved-solids concentration (3.05 percent in reach 5) than mining (0.38 percent in reach 5). However, with full-scale mining, the cumulative percentage resulting from irrigation in reach 5 (2.50 percent) will be smaller than that resulting from mining (14.69). By not simulating mining of the Kirby coal deposit in reach 1, the cumulative percentage of dissolved-solids concentration resulting from mining in all reaches will be decreased to less than 6.00 percent.
W86-01962

COMPILATION OF DATA COLLECTED AND DERIVED FOR WATER YEARS 1980 AND 1981 FOR THE PURPOSE OF WATER-QUALITY MODELING OF THE LOWER OUACHITA RIVER AND SELECTED TRIBUTARIES, SOUTH-CENTRAL ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
J. C. Petersen, and E. E. Morris.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-727, 1984. 130 p, 16 fig, 40 tab, 36 ref.

Descriptors: *Hydrologic data collection, *Water quality, *Dissolved oxygen, *Nutrients, Coliform, Stream discharge, Algae, Phytoplankton, Chlorophyll, *Arkansas, *Ouachita River, Periphyton, Stream geometry.

This report represents water-quality, sediment oxygen demand, phytoplankton, periphyton, bacteria, instantaneous and mean-daily discharge, stream geometry, time of travel, reaeration data and other water quality collected on the lower Ouachita River (from just upstream of Little Missouri River to Lock and Dam 6), West Two Bayou, Smackover Creek, Haynes Creek and selected tributaries. The data were collected primarily between August 1980 and September 1981. Over 100 sites were sampled, but most were sampled only during two intensive sampling periods in mid-August of 1980 and mid-September of 1981. The water-quality data include measurements of pH, specific conductance, dissolved oxygen, water temperature, whole-water nitrogen species, total phosphorus, total orthophosphorus, dissolved chlorides, dissolved sulfate, ultimate biochemical oxygen demand and organic carbon. The phytoplankton and periphyton data include measurements of chlorophyll a and b, taxonomic identification cell counts and weights. Limited precipitation data are also included. Maps and schematic diagrams of the lower Ouachita River, West Two Bayou, Smackover Creek and Haynes Creek drainage systems show the location of the data-collection sites within the area. (USGS)
W86-01965

GEOCHEMICAL PROCESSES IN THE GASCOYNE LIGNITE MINING AREA, BOWMAN COUNTY, NORTH DAKOTA,
Geological Survey, Reston, VA. Water Resources Div.
D. W. Fisher, D. C. Thorstenson, M. G. Croft, and R. L. Houghton.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4192, 1985. 80 p, 15 fig, 15 tab, 32 ref.

Descriptors: *Strip mines, *Water quality, *Groundwater, Chemical reactions, Carbon radioisotopes, Carbonates, Cation exchange, Aeration zone, *Coal mining effects, *Fort Union formation, *North Dakota, Dissolved gases, Gas analyses, Sulfate reduction.

A study was begun in 1975 to determine the geochemical processes that have affected groundwater quality as a result of a lignite strip mine at Gascoyne, North Dakota. Ground waters and surface waters on or near the mine were analyzed for major and minor dissolved constituents, tritium and carbon-13 isotopes, and dissolved gases. Compositions and carbon isotopes were determined in gas samples from various horizons at six unsaturated-zone sites. Mineralogic and cation-exchange data were obtained from core samples and surface solids from the mine and from nearby farms. Reactions that control ground-water chemistry at the mine include: (1) Oxidation of organic matter and ferrous iron minerals in the saturated zone; (2) Dissolution of C02, carbonates and sulfates in unsaturated-zone water; (3) Cation exchange reactions on clays and on lignite; (4) Sulfate reduction and pyrite deposition in the lignite; (5) leaching of halides and of organic matter from the lignite; and (6) Silicate hydrolysis near the lignite outcrop. Gascoyne area ground waters are near neutral to moderately alkaline sodium sulfate solutions containing several hundred to several thousand mg/L dissolved sulfate. Mining operations will probably increase the dissolved sulfate levels in the groundwater reservoir at Gascoyne. (USGS)
W86-01970

RESULTS OF THE SEPARATIONS AREA GROUND-WATER MONITORING NETWORK FOR 1981,
Atomics International Div., Richland, WA. Energy Systems Group.
J. S. Wilbur, and M. J. Graham.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-020562,

Price codes: A03 in paper copy, A01 in microfighe. Report RHO-HS-SR--5P, July 1982. 43 p, 18 fig, 4 tab, 10 ref, 6 append. DE-AC06-77RL01030.

Descriptors: *Fate of pollutants, *Water pollution sources, *Radioactive wastes, *Radioisotopes, Tritium, Monitoring, Water quality, Groundwater pollution, Hanford Site, Nuclear reactors, *Washington.

Results of the 1981 groundwater monitoring program at the Rockwell Hanford Site Separations Area indicated few changes from 1980. Samples from monitoring wells were analyzed for total alpha, total beta, Co60, Ru106, Cs137, Sr90, tritium, uranium, and nitrate. Tritium levels exceeded the guidelines for tritium (3000 pCi/ml) iin three wells which monitor active sites. With the exception of tritium, all contamination greater than 10% of the guidelines was caused by past disposal to inactive sites. The zone of contamination appears stable and highly localized for the sites represented by these samples. Groundwater migrating out of the Separations Area at this time contain pollutants at levels less than the guidelines. (Cassar-PTT)
W86-01977

ASSESSMENT AND CONTROL OF WATER CONTAMINATION ASSOCIATED WITH SHALE OIL EXTRACTION AND PROCESSING,
Los Alamos National Lab., NM.
E. J. Peterson, A. V. Henicksman, J. P. Fox, J. A. O. O'Rourke, and P. Wagner.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82 019186, Price codes: A03 in paper copy, A01 in microfiche. Report LA-9084-PR; UC-91, April 1982. 48 p, 8 fig, 23 tab, 24 ref, 3 append.

Descriptors: *Water quality control, *Oil shale, Shales, Trace elements, Metals, Heavy metals, Leaching, *Water pollution sources.

Laboratory studies on the potential water contamination associated with oil shale operations, focus on the mineralogy, trace element concentrations in solids, and leaching characteristics of raw and spent shales. Process parameters in modified in situ retorting are extreme. Mineralogic characterization of field generated spent shales indicate that carbonate decomposition and silication reactions occurred in Retort 3E at Logan Wash, Colorado. However, evaluation of leachate compositions indicate that several environmentally sensitive trace elements, including K, Li, F, V, Pb, B, Mo, Ni, Se, and As are not rendered immobile by in situ processing and could be of environmental concern. These conclusions are verified by investigations of laboratory-generated spent shales. This report details the chemical, mineralogic, and solution behavior of major, minor, and trace elements in a variety of shale materials. Control technology research activities have focused on the definition of control technology requirements based on assessment activities and laboratory evaluation of alternative control strategies for mitigation of identified problems. The overall impact of in situ processing on groundwater quality appears to be less significant than previously believed. Most elements leached from spent shales are already elevated in most groundwaters. Analysis indicates that solubility controls by major cations and anions will aid in mitigating water quality impacts with the exception of V, Pb, and Se. With respect to in situ retort leaching, process control and multistaged counterflow leaching are evaluated as control strategies. (Cassar-PTT)
W86-01979

MECHANISMS FOR GROUNDWATER CONTAMINATION BY UCG: PRELIMINARY CONCLUSIONS FROM THE HOE CREEK STUDY,
Lawrence Livermore National Lab., CA.
F. T. Wang, S. W. Mead, and D. H. Stuermer.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-020348, Price codes: A02 in paper copy, A01 in microfiche. Report UCRL--88012, August 3, 1982. 12 p, 6 fig, 5 tab, 5 ref. W-7405-E-48.

Descriptors: *Water pollution sources, *Fate of pollutants, *Water quality control, *Coal gasification, Gasification, Pyrolysis, Hoe Creek, Wyoming, Groundwater pollution, Organic compounds, Ammonia, Leaching.

Changes in groundwater quality were monitored in 60 wells drilled near the three underground coal gasification experiments at Hoe Creek, Wyoming. Five mechanisms were proposed to explain how residual gasification products were introduced into groundwater. (1) Escaping hot product gases may pyrolyze surrounding coal along its natural cracks. This is most likely to happen in an overlying aquifer. However, sand layers are not readily contaminated in this manner. If this mechanism is valid, dewatering wells could lower system pressure and reduce the volume of escaping product gas. (2) After gasification, the residual heat inside the cavity produces further pyrolysis products. (3) Leaching of coal ash by returning groundwater liberates inorganic contaminants. (4) Overburden materials heated to various degrees are the source of inorganic substances which enter the groundwater. (5) Minerals are dissolved by carbon dioxide escaping from the cavity during gasification. These possible mechanisms may be considered in designing monitoring networks and control technologies. For example, in leaky coal seams, monitoring wells should be 100 m or more from the cavity. In a thick coal seam, some wells should be completed in the top portion of the bed. Contaminated groundwater may be treated by pumping water to the surface through a wall in the cavity. The quantity of pyrolysis products can be minimized by preventing gas losses. (Cassar-PTT)
W86-01981

SEDIMENT AND RADIONUCLIDE TRANSPORT IN RIVERS: FIELD SAMPLING PROGRAM FOR CATTARAUGUS AND BUTTERMILK CREEKS, NEW YORK,
Battelle Pacific Northwest Labs., Richland, WA.
W. H. Walter, R. M. Ecker, and Y. Onishi.
Report PNL-3117, Vol. 4, Summary Report. November 1982. 75 p, 41 fig, 10 tab, 6 ref, 2 append.

Descriptors: *Path of pollutants, *Radioactive wastes, *Surface waters, *Radionuclides, *Radioisotopes, Cesium-137, Strontium-90, Plutonium, Americum, Tritium, Curium, Rivers, Sediments, Transport, Buttermilk Creek, *New York.

A field sampling program was conducted on the Buttermilk-Cattaraugus Creek system, New York, to investigate the transport of radionuclides in surface waters as part of a continuing program to provide data for application and verification of Pacific Northwest Laboratory's (PNL) sediment and radionuclide transport model, SERATRA. Based on the evaluation of radionuclide levels in Cattaraugus and Buttermilk Creeks, the Nuclear Fuel Services facility at West Valley, New York, may be the source of Cs-137, Sr-90, Cs-134, Co-60, Pu-238, Pu-239, 240, Am-241, Cm-244 and tritium found in the bed sediment, suspended sediment and water of Buttermilk and Cattaraugus Creeks. Bed sediment, suspended sediment, and water samples were collected over a 45-mile reach of the creek system. Bed sediment samples were also collected at the mouth of Cattaraugus Creek in Lake Erie. Radiological analysis of these samples included gamma ray spectrometry analysis, and radiochemical separation and analysis of Sr-90, Pu-238, Pu-239, 240, Am-241 and Cm-244. Tritium analysis was also performed on water samples. (Author's modified abstract)
W86-01988

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN GROUNDWATER MODELING: SELECTION, TESTING AND USE,
Michigan Dept. of Natural Resources, Lansing.
D. A. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-143206, Price codes: A09 in paper copy, A01 in microfiche. Volume 1, September 1982. 199 p, 98 fig, 6 tab, 62 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Groundwater management, *Model studies, *Michigan, AQUIFEM model, Mass trans
Groundwater movement, Groundwater pollu
Aquifers, Mathematical models, Water qu
Water pollution, Water quality control, Mar
ment.

Groundwater models were applied to three
problems in Michigan: a landfill leachate pl
contamination from an unknown source, and
mestic wells contaminated with chromium fro
industrial plant. The AQUIFEM model was t
at all three sites. Three different models (A
FEM, GEOFLOW, and the U.S.G.S. mass t
port model) were applied to the chromium p
tion situation. AQUIFEM was recommende
the first model to use in a given problem.
transport modeling should be attempted only i
complexity, project demand, and a large bod
available data require this model type. Some o
uses of groundwater modeling demonstrated in
study include testing working hypotheses, di
ing where new data should be obtained, simul
various management alternatives, and coordina
the final design with management implementa
(Cassar-PTT)
W86-01989

**RESEARCH PROGRAM FOR ATMOSPHE
CHEMISTRY, RADIATION AND DYNAM**
Atmospheric and Environmental Research,
Cambridge, MA.
N. D. Sze, M. K. W. Ko, M. Livshits, W. C.
Wang, and P. B. Ryan.
Available from the National Technical Informa
Service, Springfield, VA 22161 as ADA-120
Price codes: A06 in paper copy, A01 in microfi
Report No. AFGL-TR-82-0207, Final Report,
1982. 121 p, 50 fig, 5 tab, 115 ref, 2 app
F19628-81-C-0016.

Descriptors: *Chemical reactions, *Atmosph
Model studies, Ozone, Metals, Heavy metals,
trogen oxides, *Acid rain, *Path of pollut
Water pollution sources, *Atmospheric chemis

Progress is summarized in atmospheric rese
conducted under AFGL contract F19628-8
0016 for the period December 1980 to June 1
Four topics are discussed. (1) New rates for
reactions of OH with HNO3 and HNO4 introd
additional coupling between HOx and NOx
cies, reducing the OH and HO2 concentration
the lower stratosphere. (2) The calculated ste
state ozone depletion due to continued releas
fluorocarbons at the 1977 production level is 6.
compared with the depletion rate (16.4%) calcu
ed from 1979 rates. Ozone perturbations du
human activity may interact in nonlinear fash
For example, an increase in atmospheric car
dioxide may partially offset the fluorocarbon
duced ozone perturbation. (3) The AER two
mensional model results were compared with
servations of atmospheric gases. Important disc
ancies still exist in ClO and some fluorocarb
(4) Studies on meteoric metals in the atmosp
indicate that metal species have the potential
couple to other chemical cycles and change rad
species concentrations. (Cassar-PTT)
W86-01996

**PHYSICAL BEHAVIOR OF PCBS IN T
GREAT LAKES.**
For primary bibliographic entry see Field 5A.
W86-02012

**VAPOR EXCHANGE OF PCBS WITH LA
MICHIGAN: THE ATMOSPHERE AS A SI
FOR PCBS,**
De Paul Univ., Chicago, IL.
T. J. Murphy, J. C. Pokojowczyk, and M. D. Mullin.
IN: Physical Behavior of PCBs in the Great Lak
Ann Arbor Science, Ann Arbor, MI. 1983. p 49-
3 tab, 10 ref. CR-807412.

Descriptors: *Path of pollutants, *Toxic was
*Polychlorinated biphenyls, *Atmosphere, *
porization, *Lake Michigan, Great Lakes, Henr
law constants, Chlorobiphenyls, Gas chromatog
phy, Aroclors.

Research was conducted to answer the question of whether there is net transport of PCB vapor into or out of the water, a major problem remaining in determining the PCB budgets of the Great Lakes. These studies indicate that the net movement of PCB vapor is from the water to the atmosphere. The methods used to draw these conclusions involve determining the ratios of PCB concentrations in solution and in vapor above the solution. The ramifications of the results of this work with regard to precipitation are as follows: a water concentration of 1 ng/l of a PCB with Henry's law constant (HLC of 0.00033 atm-cu m/mol) will support a vapor PCB concentration of 13.3 ng/cu m. Thus, precipitation in equilibrium with an atmospheric vapor concentration of 2 ng/ cu m of PCB, will have a dissolved PCB concentration of 0.15 ng/l. This is a concentration two orders of magnitude or more lower than is normally found in precipitation and indicates that vapor scavenging can account for less than 1% of the wet deposition PCB inputs. (Halterman-PTT)
W86-02014

PHYSICAL CHEMICAL PROPERTIES OF POLYCHLORINATED BIPHENYLS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5A.
W86-02015

REACTIVITY AND ENVIRONMENTAL PERSISTENCE OF PCB ISOMERS,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
For primary bibliographic entry see Field 5A.
W86-02016

REVERSIBLE AND RESISTANT COMPONENT MODEL OF HEXACHLOROBIPHENYL ADSORPTION-DESORPTION RESUSPENSION AND DILUTION,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
For primary bibliographic entry see Field 5A.
W86-02017

PCBS IN THE LAKE SUPERIOR ATMOSPHERE 1978-1980,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 5A.
W86-02018

PROCESSES DETERMINING THE FLUX OF PCBS ACROSS AIR/WATER INTERFACES,
Wisconsin Univ.-Madison.
A. W. Andren.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 127-140, 1 fig, 4 tab, 39 ref.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Lake Michigan, Great Lakes, Air-water interface, Vapor particle partitioning, Vaporization, Adsorption, Desorption, Model studies.

Because of the high concentrations of PCBs in fish eaten by humans, it is important to understand the routes by which PCBs first enter the water and ultimately fish tissues. In order to evaluate these transport processes, it is instructive to study the environmental behavior of these compounds. The primary phenomenon noted here is the atmospheric removal of the particle-associated fraction. The overall input of PCBs to Lake Michigan was estimated to range from about 300 to 550 kg per year. These estimates were obtained by combining a series of models and data, obtained from published literature, which covered the major transport mechanisms. Estimates were made for inputs from vapor-particle partitioning, vapor washout, particle-associated washout, dry deposition of particle-associated PCBs, vapor phase transfer, bubble stripping and bubble bursting. (Halterman-PTT)
W86-02019

EVIDENCE FOR THE ATMOSPHERIC FLUX OF POLYCHLORINATED BIPHENYLS TO LAKE SUPERIOR,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
S. J. Eisenreich, and B. B. Looney.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 141-156, 1 fig, 3 tab, 36 ref.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Great Lakes, *Lake Superior, Air-water Partition coefficients, Air pollution, Transport, Water pollution, Model studies, Air-water interface.

Because of the magnitude of the PCB concentrations in marine, the Great Lakes, and urban atmospheres, atmospheric transport has been implicated as a primary input pathway to aquatic ecosystems. The calculation of PCB vapor flux across the air/water interface, which is critically important in quantifying atmospheric inputs, is described and quantified. Determinations were made by using reported air/water partition coefficients and comparing the results to a surface flux estimated from PCB and temperature profiles observed in Lake Superior, July 1978. The surface influx of PCB from the atmosphere was estimated as about 0.02 to 0.2 micrograms per square meter per day as compared to the gas-phase controlled influx calculated as about 0.17 micrograms per square meter per day. (Halterman-PTT)
W86-02020

ROLE OF SURFACE MICROLAYERS IN THE AIR-WATER EXCHANGE OF PCBS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
C. P. Rice, P. A. Meyers, and G. S. Brown.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 157-179, 4 fig, 5 tab, 31 ref. NA-79 RA-H-00001 NA-80 AA-D-00072.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Lake Michigan, *Air-water exchange, Surface microlayers, Air-water interface, Great Lakes, Aroclors, Suspended solids, Partition coefficients.

Recently, there is much interest in trying to explain the cycling of PCBs between the major environmental compartments, i.e., atmosphere, hydrosphere and lithosphere, and hence new compartments are being defined. One of these is the surface microlayer. Determinations of the concentrations of PCB in the microlayer and subsurface waters of Lake Michigan are presented. Results of these studies indicate that the portion of PCBs associated with the particulate phase is related to their cycling at this interface. Surface samples for the study were collected from throughout Lake Michigan during 1979 and 1980 with screen and plate samplers. Subsurface samples were collected from a 1 m depth. Data on concentrations of PCBs, suspended particulates, and partition coefficients for the surface microlayer and the subsurface waters are presented. (Halterman-PTT)
W86-02021

PCB DYNAMICS IN LAKE SUPERIOR WATER,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
S. J. Eisenreich, P. D. Capel, and B. B. Looney.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 181-211, 8 fig, 4 tab, 46 ref. R805172-01. R806084-01.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Lake Superior, Great Lakes, Water pollution, Sediment-water interfaces, Suspended solids, Aroclors, Adsorption.

PCBs are refractory compounds resisting chemical and biological degradation and are predicted to remain active for decades to come. Consequently, it is important to determine the dynamics of these compounds in aquatic ecosystems. A summary is presented of the findings regarding PCBs in the waters of Lake Superior during 1978 to 1980. Samples were taken from subsurface and surface waters, extracted, and analyzed by gas chromatography. Data on variations in concentrations of PCBs in various regions of Lake Superior, as well as in-depth profiles, are presented. (Halterman-PTT)
W86-02022

ROLE OF THE BENTHIC BOUNDARY IN THE CYCLING OF PCBS IN THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
B. J. Eadie, C. P. Rice, and W. A. Frez.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 213-228, 5 fig, 2 tab, 24 ref.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Sediment-water interface, Great Lakes, Lake Michigan, Suspended solids, Sedimentation, Water pollution, Transport, Partition coefficients, Air pollution.

Transport processes within the benthic boundary layer (BBL) are important in determining the residence times of compounds, such as PCBs, in the Great Lakes. A review of the available information on this topic is presented, as well as the results of studies on recent sediment accumulation, resuspension, and transport of PCBs within the BBL. Data from analyses of water column and sediment trap samples indicate that approximately 14% of the current water column inventory of particle-associated PCB can be accounted for by winter resuspension. Reentrainment of pore water-associated PCB is small, but may be significant if associated with soluble natural organics or colloidal material. The net effect of resuspension is to increase the residence time for contaminants in active ecosystems. (Halterman-PTT)
W86-02023

PCB ACCUMULATION IN SOUTHERN LAKE MICHIGAN SEDIMENTS: EVALUATION FROM CORE ANALYSIS,
Wisconsin Univ.-Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 5A.
W86-02024

PCBS IN SEDIMENT AND FLUVIAL SUSPENDED SOLIDS IN THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
R. L. Thomas, and R. Frank.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 245-267, 3 fig, 7 tab, 28 ref.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Great Lakes, Sediments, Water pollution, Suspended solids, Lake Superior, Lake Michigan, Lake Erie, Lake Huron, Lake Ontario, Lake St. Clair.

PCBs are ubiquitous in the Great Lakes water column, sediment and fish. However, the extent of their distribution is thought to be best demonstrated in bottom sediment and sediment introduced by rivers and lake drainage. Levels of PCBs observed within the Lakes reflect point and diffuse sources from industrial regions (high levels) within the basin as well as widely dispersed origins from the atmosphere (low levels). This program entailed sampling a grid pattern of 216 stations in Lake Ontario in 1968; 176 stations in Lake Huron in 1969; 55 stations in Lake St. Clair in 1970 and 1974; 259 stations in Lake Erie in 1971; 214 stations in the Bay of Quinte in 1972-1973; 405 stations in Lake Superior, 115 stations in Georgian Bay and 55 stations in North Channel in 1973; and 279 stations in Lake Michigan in 1975. (Halterman-PTT)
W86-02025

ESTIMATING BIOCONCENTRATION POTENTIAL FROM OCTANOL/WATER PARTITION COEFFICIENTS,

Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5A.
W86-02026

STEADY STATE MODELING OF TOXIC CHEMICALS-THEORY AND APPLICATION TO PCBS IN THE GREAT LAKES AND SAGINAW BAY,
Manhattan Coll., Bronx, NY.
R. V. Thomann, and J. A. Mueller.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 283-309, 11 fig, 4 tab, 14 ref. CR 07853-01.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Great Lakes, Saginaw Bay, Model studies, Suspended solids, Water pollution, Toxicity transport, Volatility.

Understanding the fate of a chemical such as PCB in a natural water system one must recognize the dynamic relationship between atmospheres, water column andd sediments. However, there are several advantages to using steady state calculations. The authors developed a simplified steady state model that provides increased understanding of the processes that are operative and permits unambiguous estimations of model parameters. The mechanisms that result from the derivation of the model are presented, with specific reference to PCBs. The application of the model to Saginaw Bay and the Great Lakes as a whole is presented. Predictions of PCB loadings, volatilization, PCB concentrations, fluxes to sediments, and fluxes to downstream are also made. (Halterman-PTT)
W86-02027

MODEL SIMULATION OF PCB DYNAMICS IN LAKE MICHIGAN,
De Paul Univ., Chicago, IL.
For primary bibliographic entry see Field 5A.
W86-02028

DYNAMIC MASS BALANCE OF PCB AND SUSPENDED SOLIDS IN SAGINAW BAY -- A CASE STUDY,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
W. L. Richardson, V. A. Smith, and R. Wethington.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 329-366, 15 fig, 9 tab, 19 ref.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Great lakes, *Saginaw Bay, Aroclors, Lake Huron, Model studies, Suspended solids, Water pollution, Air pollution, Transport, Volatility, Sedimentation, Mass balance.

A serious problem concerning PCBs in the Great Lakes area is how long PCB concentrations in fish will remain above the FDA action limit of 5 mg per kg. Many 'reservoirs', including landfills, roads sealed with PCB-oil mixtures, contaminated sediments and long-range atmospheric transport and deposition, still act as sources of contamination, In order to answer questions posed by regulators concerning the possible future status of PCBs, studies were conducted on data obtained in the Great Lakes region during 1979. Studies resulted in the development of a model for the dynamic mass balance of PCB and suspended solids in Saginaw Bay. The model was used to determine volatilization rates and to estimate the expected longevity of PCBs in the system. The model was constructed with 1979 data on PCB concentrations in the water column (total, dissolved, particulate), suspended solids, mass PCB on solids and distribution coefficients. The best comparison of model simulations to the measured concentrations was made with the distribution coefficients for A 1242, of about 60% of those for A 1260 and with a volatilization rate for Aroclor 1242 of 0.2 m per day. The volatilization rate for a 1260 was determined to be no more than 0.05 m per day. The calibrated volatilization rate for Aroclor 1242 compares well with the theoretical value, but that calibrated for Aroclor 1260 is much smaller than the theoretical value. Total PCB is calculated to decrease by 90% within 10 years. (Halterman-PTT)
W86-02029

MONITORING OF PCBS IN WATER, SEDIMENTS AND BIOTA OF THE GREAT LAKES - SOME RECENT EXAMPLES,
Ontario Ministry of the Environment, Toronto.
For primary bibliographic entry see Field 5A.
W86-02030

VOLATILIZATION OF PCB FROM SEDIMENT AND WATER: EXPERIMENTAL AND FIELD DATA,
New York State Dept. of Environmental Conservation, Albany.
T. J. Tofflemire, T. T. Shen, and E. H. Buckley.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 411-422, 1 fig, 42 ref.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Volatility, Sediments, Control techniques, Vegetation, Water pollution, Air pollution, Transport, Air-water interface, Waste dumps.

As for a number of toxic chlorocarbons, the volatilization losses of PCB are substantial in spite of very low vapor pressures. Studies were conducted on PCB volatilization, air monitoring, and PCB levels in vegetation. Data indicate that volatilization of PCBs can be an important source of air pollution under certain environmental conditions. PCB concentrations are fairly high in ambient air and in vegetation near PCB dump sites. Air concentrations are 0.002 to 0.11 of the sediment concentrations. Extremely high levels of PCBs (up to 2800 ppm) were found in plants growing on PCB dumps, while levels of 0.1 or 0.2 ppm were observed in plants collected in areas removed from known sources. (Halterman-PTT)
W86-02031

APPLICATION OF A SEDIMENT DYNAMICS MODEL FOR ESTIMATION OF VERTICAL BURIAL RATES OF PCBS IN SOUTHERN LAKE MICHIGAN,
Environmental Research Lab.-Duluth, MN.
D. Weininger, D. E. Armstrong, and D. L. Swackhamer.
IN: Physical Behavior of PCBs in the Great Lakes, Ann Arbor Science, Ann Arbor, MI. 1983. p 423-439, 6 fig, 2 tab, 13 ref. 68-01-0502.

Descriptors: *Path of pollutants, *Toxic wastes, *Polychlorinated biphenyls, *Sedimentation, *Lake Michigan, Sediments, Water pollution, Model studies, Great Lakes, Transport.

The rate of recovery of Lake Michigan from PCB contamination is affected by the release of PCBs from the sediments. Sedimentation acts as a burial process, rendering the PCB-laden surficial sediments as sinks. A sediment dynamics model is presented for use in estimating these vertical burial rates. An expected response of Lake Michigan sediments to burying surficial PCBs is 5 - 10 years. It appears that the surficial sediments over most of the southern basin have reached their maximum PCB concentration and are now decreasing in concentration. (Halterman-PTT)
W86-02032

ECOLOGICAL EFFECTS OF ACID PRECIPITATION,
Sigma Research, Inc., Richland, WA.
For primary bibliographic entry see Field 5C.
W86-02039

HAZARDOUS AND TOXIC WASTES: TECHNOLOGY, MANAGEMENT AND HEALTH EFFECTS,
The Pennsylvania Academy of Science, Easton, PA. 1984. Edited by S. K. Majumdar and E. W. Miller. 442 p.

Descriptors: *Fate of pollutants, *Water pollution sources, *Waste disposal, Water quality control, Landfills, Geology.

Selected papers from this volume concerning water resources include hazardous waste disposal by pozzolanic cementation, geological factors in disposal site selection, the time perspective in waste management, selection of suitable sites for constructing hazardous waste facilities, and the character, fate, and effects of coal tar wastes. (Cassar-PTT)
W86-02041

TIME PERSPECTIVE IN THE SUBSURFACE MANAGEMENT OF WASTE,
Pennsylvania State Univ., University Park.
R. R. Parizek.
IN: Hazardous and Toxic Wastes: Technology, Management and Health Effects, The Pennsylvania Academy of Science, Easton, PA. 1984. p 139-169, 8 fig, 8 tab, 24 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Groundwater pollution, Organic compounds, Aquifers, Solute transport, Geohydrology, Geochemistry, Waste disposal, Rivers, Sediments, Lakes, Estuaries, Metals, Water quality.

Groundwater pollution from waste disposal sites may not be apparent in the short term. The time perspective is very important in waste management because many pollutant transport processes are not well understood on the scale of thousands of years. Of urgent concern are hydrologically active areas, land areas which contribute pollutants directly to ground and/or surface waters, even during minor precipitation events. Pollutants may enter drainage basins via the atmosphere, rivers and streams, groundwater, and erosion in lakes and estuaries. Each pathway has its own travel time, attenuation mechanisms, and control measure potential. The effects of toxic substances in lake sediments are exaggerated because of recycling and biomagnification. Wastes are characterized according to persistence and toxicity. Easily biodegradable substances are less likely to survive long-term transport in slowly moving systems, whereas highly persistent compounds and metals may pose hazards for many years. Conditions favoring contamination of groundwater are permeable surficial deposits, great differences in permeability between surface and bedrock layers, low relief terrain, drainage tiles, sinkholes, secondary openings in bedrock, shallow aquifers, and confined aquifers. (Cassar-PTT)
W86-02044

COAL TAR WASTES: THEIR ENVIRONMENTAL FATE AND EFFECTS,
Pennsylvania Power and Light Co., Allentown.
J. F. Villaume.
IN: Hazardous and Toxic Wastes: Technology, Management and Health Effects, The Pennsylvania Academy of Science, Easton, PA. 1984. p 362-375, 3 fig, 3 tab, 22 ref.

Descriptors: *Water pollution sources, *Fate of pollutants, Coal gasification, Coal tar, Metals, Cyanide, Organic compounds, Adsorption, Wastewater treatment.

Coal tar, a byproduct of coal gasification, is a complex mixture of free carbon and up to 10,000 organic compounds, principally polynuclear aromatic hydrocarbons. In the past much of this by-product was disposed of in injection wells or lagoons. Several instances of drinking water well contamination by coal tar have been reported. The chief problems are taste and odor, heavy metals and cyanide. Free coal tar readily moves through the unsaturated zone only where the water table is deep or where the tar is less dense than water. In the saturated zone coal tar denser than water moves in a separate liquid phase according to the distribution of capillary pressure forces. At Stroudsburg, Pa., 8000 gallons of nearly pure coal tar have been recovered in a depression in relatively impermeable silty sand. Phenolics and naphthalene levels increase more rapidly in groundwater than simple dilution can produce. Available reme-

dial actions include containment with a bentonite slurry wall, pumping of coal tar collected in pools, ime treatment mixture with a proprietary diluent, ydraulic isolation, and emulsification with in situ vater flooding. However, these methods are costly nd not always immediately and totally effective. Cassar-PTT)
W86-02046

STUARY AS A FILTER,
For primary bibliographic entry see Field 2L.
W86-02070

STUARY AS A FILTER: AN INTRODUCTION,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2L.
W86-02071

URBULENCE AND MIXING IN ESTUARIES,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W86-02072

RANSPORT VARIABILITY IN A FJORD,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2L.
W86-02074

STUARINE INTERACTION OF NUTRIENTS, RGANICS, AND METALS: A CASE STUDY IN HE DELAWARE ESTUARY,
Delaware Univ., Lewes. Coll. of Marine Studies.
For primary bibliographic entry see Field 2L.
W86-02081

NTHROPOGENIC NITROGEN LOADING ND ASSIMILATION CAPACITY OF THE UDSON RIVER ESTUARINE SYSTEM, USA,
Maryland Univ., Cambridge. Center for Environmental and Estuarine Studies.
For primary bibliographic entry see Field 2L.
W86-02083

NVIRONMENTAL CHARACTERIZATION OF HESAPEAKE BAY AND A FRAMEWORK OR ACTION,
Environmental Protection Agency, Annapolis, MD. Chesapeake Bay Program.
For primary bibliographic entry see Field 2L.
W86-02092

OCATING THE GROUNDWATER POLLUION SOURCES USING COMPUTER ODELS,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
D. Hwang, A. Ayubcha, J. S. Chieh, and S. Richardson.
In: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 534-547, 9 fig. 4 tab, 5 ref.

Descriptors: *Groundwater pollution, *Water pollution sources, *Computer models, *Numerical analysis, *Solute transport, Test wells, Organic solvents, Fate of pollutants, Model studies, Monitoring.

Two different computer numerical approaches were used to locate groundwater pollution sources at the Emmaus site, Little Creek Valley, Pennsylvania: nonsequential and sequential optimization. Results for detecting trichloroethylene (TCE) pollution sources in test wells are presented. TCE in this site study is assumed to be a dissolved pollutant dispersed in and convected by the groundwater. The actual point source was later determined to be about 100 ft from the node showing the highest pollutant concentrations. The models were applied to solute transport studies for TCE at the Curtiss Cell Pollution Site in Southington, Connecticut. Initial investigations indicated that the groundwater pollution at the well may have started as early as 1955. The results clearly demonstrate that there is an area-source in the northwest side of Quinnipac River and a point source south-southwest to one of the production wells. The computer prediction of area source location agrees quite well with the actual field investigation results. This technique holds the promise of being able to determine where additional wells should be located for on-going pollution monitoring. (Geiger-PTT)
W86-02121

WATER CHLORINATION: ENVIRONMENTAL IMPACT AND HEALTH EFFECTS; VOLUME 4, BOOK 1: CHEMISTRY AND WATER TREATMENT,
For primary bibliographic entry see Field 5F.
W86-02135

SUMMARY OF STUDIES ON MODELING PERSISTENCE OF DOMESTIC WASTEWATER CHLORINE IN COLORADO FRONT RANGE RIVERS,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
T. J. Heinemann, G. F. Lee, R. A. Jones, and B. W. Newbry.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 97-112, 4 fig, 2 tab, 12 ref.

Descriptors: *Fate of pollutants, *Wastewater treatment, *Chlorination, *Chloramines, Model studies, Colorado Front Range, Effluents, Kinetics.

A modeling approach has been developed based on several Colorado Front Range streams in the vicinity of chlorinated wastewater treatment plant effluent discharges to estimate the persistence of chloramines in natural water systems. It was found through a series of simple measurements and tests that rate constants can be developed to describe the dissipation rate of chlorine and its dilution so that estimates can be made of the persistence of the chlorine downstream of the wastewater treatment plant discharges. This approach reliably predicts chlorine persistence in most sites evaluated and has been verified to a limited extent in Colorado Front Range streams. (Author)
W86-02141

NATURAL DECHLORINATION KINETICS OF SECONDARY MUNICIPAL EFFLUENTS,
Beak Consultants Ltd., Mississauga (Ontario).
For primary bibliographic entry see Field 5D.
W86-02142

EFFECT OF BROMIDE AND NITRITE ON THE DEGRADATION OF MONOCHLORAMINE,
California Univ., Berkeley. Lawrence Berkeley Lab.
R. L. Valentine, and R. E. Selleck.
IN: Water Chlorination: Environmental Impact and Health Effects: Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 125-137, 7 fig. 2 tab, 14 ref. W-7405-eng-48.

Descriptors: *Fate of pollutants, *Chlorination, *Chloramines, Nitrites, Bromides, Monochloramine, Chemical degradation, Catalysts, Kinetics, Oxidation.

The effect of nitrite on monochloramine disappearance in the presence of bromide was evaluated by measuring total oxidant concentration with time using monochloramine with nitrite, with bromide, and with nitrite and bromide. Nitrite in the presence of bromide greatly accelerated the rate of oxidant decay, which was independent of the initial monochloramine concentration. The nitrite was not significantly consumed in a 1:1 stoichiometric oxidation by monochloramine. If the effect of nitrite is catalytic, it may also accelerate other oxidation-reduction reactions. If not, a complex-oxidation reduction, possibly involving bromide as a catalyst, is indicated. (Cassar-PTT)
W86-02143

CHEMISTRY OF COMBINED RESIDUAL CHLORINATION,
California Univ., Berkeley. Div. of Sanitary, Environmental, Coastal, and Hydraulic Engineering.
S. F. Leao, and R. E. Selleck.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983, p 139-149, 6 fig, 10 ref. W-7405-eng-48.

Descriptors: *Fate of pollutants, *Chlorination, *Chloramines, Chlorine residual, Kinetics, Ammonia, Chemical degradation.

The decomposition of monochloramine and dichloramine was observed at pH 6.6. Monochloramine decayed continuously (described as second-order at low concentrations), reaching a rather flat peak at about 120 hours. Dichloramine concentrations increased slightly up to about 10 hours, then continuously decreased. The overall second-order rate decreased with larger ammonia concentrations. The concentration of dichloramine was more or less independent of ammonia concentration. This shows that, in the absence of free chlorine, the concentration of ammonia does not appear to affect the rate of disappearance of the residual other than through the formation of NHC12 by NH2C1 hydrolysis. The reaction between NHC12 and ammonium ion to form NH2C1 is either much slower than reported or has a rate-limiting step not involving ammonia or ammonium ion. (Cassar-PTT)
W86-02144

PRODUCT DISTRIBUTION AND RELATIVE RATES OF REACTION OF AQUEOUS CHLORINE AND CHLORINE DIOXIDE WITH POLYNUCLEAR AROMATIC HYDROCARBONS,
Minnesota Univ.-Duluth. Dept. of Chemistry.
R. J. Liukkonen, S. Lin, A. R. Oyler, M. T. Lukasewycz, and D. A. Cox.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 151-165, 3 tab, 41 ref. EPA R807455.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Aromatic hydrocarbons, Chlorine, Chlorine dioxide, Polynuclear aromatic hydrocarbons, Organic compounds, Oxidation, Kinetics.

Substituting chlorine dioxide for chlorine in water treatment was studied by treating aqueous solutions of polynuclear aromatic hydrocarbons (PAHs) with either compound. Two major considerations were indicated. (1) The reaction rates of chlorine dioxide with PAHs in water were slower than those of chlorine. Chlorine dioxide reactions paralleled the half-wave potential of the PAHs. (2) The products formed by reaction of the PAHs with chlorine and chlorine dioxide were generally similar (phenols, quinones, chloro derivatives) with structural variations dependent on the particular reactive species such as molecular chlorine, hypochlorous acid, hypochlorite, or hlorine dioxide). A table lists about 20 PAHs and their reaction times, and depicts the structures of the reaction products. (Cassar-PTT)
W86-02145

REACTIONS OF CHLORINE AND CHLORINE DIOXIDE WITH FREE FATTY ACIDS, FATTY ACID ESTERS, AND TRIGLYCERIDES,
Florida Univ., Gainesville. Dept. of Food Science and Human Nutrition.
H. A. Ghanbari, W. B. Wheeler, and J. R. Kirk.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 167-177, 1 fig, 3 tab, 10 ref. PFR 78-27067.

Descriptors: *Fate of pollutants, *Chlorination, *Lipids, *Fatty acids, *Organic compounds, Chlorine, Chlorine dioxide, Triglycerides.

The following lipids were chlorinated with hypochlorous acid and chlorine dioxide: oleic acid, methyl oleate, linoleic acid, methyl linoleate, linolenic acid, methyl linolenate, arachidonic acid, methyl arachidonate, triolein, olive oil triglycerides, and wheat germ triglycerides. Rate constants were determined. The free fatty acids were more reactive toward the chlorinating agents than their corresponding esters. For example, the rate constant for hypochlorous acid reacting with oleic acid was -11.44 per min; foor methyl oleate, -76.13 per min. Reaction with labeled chlorinating agents showed that fatty acids incorporated more chlorine than the corresponding esters. Oleic acid reacted with hypochlorous acid for 60 min incorporated 10.4% of the chlorine; methyl oleate, 1.67%. The major product of oleic acid and hypochlorous acid was identified as 9-chloro, 10-hydroxyl methyl stearate. (Cassar-PTT)
W86-02146

CHLORINATION PRODUCTS FROM AQUATIC HUMIC MATERIAL AT NEUTRAL PH,
North Carolina Univ. at Chapel Hill. School of Public Health.
D. L. Norwood, J. D. Johnson, R. F. Christman, and D. S. Millington.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 191-200, 3 fig, 1 tab, 14 ref. CR 806679.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Humic acids, *Fulvic acids, *Organic matter, Chlorine demand, Organic compounds, Aromatic compounds.

Products of the aqueous chlorination of a natural humic material at pH 7 were identified with a double-focusing, magnetic mass spectrometer capable of fast scan rates. Three common features were noticeable. (1) All compounds were methyl esters with the exception of chloroform and chloral. (2) Most compounds contained chlorine. Examples are methyl mono-, di-, and trichloroacetate, methyl-2,2-dichloropropionate, dimethylmonochlorosuccinate, dimethylmonochloromaleate, dimethyldichloromalonate, dimethyldichlorossucinate, and dimethyldichloramaleate. (3) Most non-chlorine-containing compounds were aromatic. Examples are dimethylphthalate and isomers, benzene tricarboxylic acid trimethyl ester, and benzene tetracarboxylic acid tetramethyl ester. Both fulvic acid and humic acid fractions produced extremely similar products. However, the fulvic chlorination sample contained 60% more organically bound chlorine than the humic sample, even though the reaction time of the humic sample was twice as long. (Cassar-PTT)
W86-02148

FULVIC ACID AND CHLORINATED FULVIC ACID IN WATER AND SEDIMENT: HPLC FRACTIONATION AND SPECTROSCOPIC CHARACTERIZATION,
North Texas State Univ., Denton. Inst. of Applied Sciences.
F. Y. Saleh, and M. Mokti.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 201-217, 8 fig, 3 tab, 14 ref. R-8058-22.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Fulvic acids, *Organic matter, Chlorine demand, Trihalomethanes, Organic compounds, Liquid chromatography, Lakes, Sediments.

Fulvic acid, obtained from water and sediment from three reservoirs in Texas, Oklahoma, and Louisiana, and chlorinated fulvic acid were fractionated and characterized by high performance liquid chromatography using C-108 column, weak anion exchange and reverse-phase. The fulvic acids from different sources had common characteristic components. The pH profile of the carrier solvents and the extent of protonation of the fulvic acid macromolecule controlled the fractionation. The higher the apparent molecular weight of the fulvic acid, the less its potential for trihalomethane formation. (Cassar-PTT)
W86-02149

ORGANIC REACTION PRODUCTS OF CHLORINE DIOXIDE AND NATURAL AQUATIC FULVIC ACIDS,
North Carolina Univ. at Chapel Hill. School of Public Health.
C. A. Colclough, J. D. Johnson, R. F. Christman, and D. S. Millington.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 219-229, 3 fig, 2 tab, 9 ref. R804430.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Fulvic acids, *Chlorine dioxide, Chlorine demand, Organic matter.

The oxidation of aquatic humic materials by chlorine dioxide was conducted at ph 7.8 to simulate natural surface water conditions and at pH 3 to take advantage of the full oxidizing activity of chlorine dioxide. About 70% of the original total organic carbon was recovered after the reaction; about 30% was lost as carbon dioxide or other volatile compounds. Products isolated represented only a small fraction of the initial fulvic material, much of which did not degrade sufficiently for analysis by the techniques used. Products produced at pH 7.8 and at pH 3 did not differ significantly. Of the identified compounds, most were methyl esters of the following classes: benzenepolycarboxylic acid methyl esters, aliphatic dibasic acid dimethyl esters, carboxyphenylglyoxylic acid methyl esters, and aliphatic acid monomethyl esters. Benzene di- and tricarboxylic acid methyl esters and palmitic esters and their isomers were found in abundance in both the undegraded control and the chlorinated product mixture. Also identified were methylated aromatic derivatives of glyoxylic acid, furan and dioxane derivatives, monochloromalonic acid dimethyl ester, monochlorosuccinic acid dimethyl ester, and dichloroacetic acid methyl ester. Results indicate that, at neutral pH, only limited reaction occurs between chlorine dioxide and aquatic fulvic acid. (Cassar-PTT)
W86-02150

INFLUENCE OF AQUATIC HUMIC SUBSTANCE PROPERTIES ON TRIHALOMETHANE POTENTIAL,
Canada Centre for Inland Waters, Burlington (Ontario).
B. G. Oliver, and E. M. Thurman.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 231-241, 3 fig, 2 tab, 26 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Humic acids, Organic matter, Chlorine demand, Color, Trihalomethanes, Chlorinated hydrocarbons, Fulvic acids, Phenols.

There are site variations in trihalomethane (THM) potential for humic materials from diverse climatic and geologic environments. Groundwater humics had the lowest THM potentials, marsh-bog humics had the highest THM potentials, and surface water humics had intermediate THM potentials. Trends of higher THM potential with higher phenolic content and larger molecular size were observed, but the best correlation was between THM potential and color. Color was used to predict the THM potential of various natural waters. (Author)
W86-02151

EMPIRICAL MODEL FOR PREDICTING CHLOROFORM FORMATION FROM HUMIC AND FULVIC ACIDS,
B. A. Engerholm, and G. L. Amy.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 243-252, 3 fig, 2 tab, 16 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Organic matter, Humic acids, Fulvic acids, Chlorine demand, Model studies, Trihalomethanes, Chloroform, Chlorinated hydrocarbons.

A multiparameter equation was developed for predicting chloroform formation from humic substances in water. The basic equation for humic acid encompasses the reaction time, temperature, pH, and the initial total organic carbon and chlorine/total organic carbon ratio. Also presented is a generalized equation, containing precursor-related constants, for predicting the chloroform concentration derived from fulvic acid or other precursors. Application of this equation is limited to situations in which a free chlorine residual is present and requires caution for reaction times of less than 1 hour or greater than 96 hours. (Author)
W86-02152

FORMATION OF TRIHALOMETHANES FROM THE HALOGENATION OF 1,3-DIHYDROXYBENZENES IN DILUTE AQUEOUS SOLUTION: SYNTHESIS OF 2-13 C-RESORCINOL AND ITS REACTION WITH CHLORINE AND BROMINE,
California Inst. of Tech., Pasadena. Dept. of Environmental Engineering Science.
S. D. Boyce, A. C. Barefoot, D. R. Britton, and J. F. Horning.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1; Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 253-267, 6 fig, 2 tab, 20 ref. C3049NAET.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Organic matter, Resorcinol, Dihydroxybenzenes, Aromatic compounds, Trihalomethanes, Chloroform, Bromoform, Chlorine demand, Bromination, Chemical reactions.

Halogenation of labeled resorcinol (1,3-dihydroxybenzene) produced labeled chloroform, labeled bromoform, and other products. This indicates that trihalomethane formation occurs via electrophilic halogenation and subsequent bond clevage at the C2 site of the aromatic ring. Five generalizations were made from this study. (1) In acidic, neutral, or alkaline solution 1,3-dihydroxyaromatic substrates react with chlorine and bromine to produce higher yields of chloroform and bromoform than do the corresponding 1,2- and 1,4-dihydroxy isomers. (2) Maximum yields of trihalomethanes from 1,2-dihydroxyaromatic compounds occur between pH 8 and 10. (3) Bromination of acetone, 2-butanone, and 2-pentanone shows pH dependence of bromoform yields. Chlorination of these compounds does not produce significant chloroform. (4) All bromination reactions produce equivalent yields of bromoform as measured by direct injection analysis. Chlorination reactions produce higher yields for each substrate at low pH. This difference may have been the result of formation of labile chloroform-substituted intermediates in acidic solution which decomposed to chloroform during analysis. (5) Each 1,3-dihydroxyaromatic substrate shows a maximum chloroform or bromoform yield at a reactant ratio (halogen/substrate) of 7, except for 1,3-dihydroxynaphthalene (Maximum at 5:1). (Cassar-PTT)
W86-02153

KINETICS AND MECHANISM OF HALOFORM FORMATION: CHLOROFORM FORMATION FROM TRICHLOROACETONE,
Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
M. D. Gurol, A. Wowk, S. Myers, and I. H. Suffet.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 269-284, 9 fig, 3 tab, 16 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, Chlorine demand, Chloroform, Trichloroacetone, Organic compounds, Chlorinated hydrocarbons, Chemical reactions, Hydrolysis.

The kinetics and mechanism of trichloroacetone (TCA) degradation was studied to determine

whether any chloroform is formed by this pathway. TCA at concentrations of 7 to 40 mg/liter was reacted at 25 degrees C at pH of 6 to 8 in the presence of 0 to 75 mg/liter chlorine. Hydrolysis and chlorination of TCA occurred simultaneously in chlorinated water. The total rate of chloroform formation by these two reaction pathways is too slow to account for the chloroform concentrations observed under typical conditions of water treatment. For example, at pH 7 and with free available chlorine of 10 mg/liter, only 10% of TCA degrades into chloroform during a contact time of 60 min. This corresponds to the formation of about 0.07 micrograms/liter of chloroform if the steady-state concentration of TCA in water is 1 microgram/liter. An additional 3 microgram/liter of chloroform is expected to form in the distribution system after 5 days in the presence of 2 mg/liter free available chlorine. A reaction that causes further halogenation of the chlorinated intermediate with eventual degradation to chloroform occurs simultaneously with hydrolysis of the chlorinated intermediate to chloroform, as opposed to the haloform reaction. The reaction between TCA and chlorine is faster than the hydrolysis reaction for chlorine concentrations above 1.5 mg/liter and at neutral pH. (Cassar-PTT)
W86-02154

QUANTITATIVE EFFECTS OF BROMINE ON THE FORMATION AND DISTRIBUTION OF TRIHALOMETHANES IN GROUNDWATER WITH A HIGH ORGANIC CONTENT,
Florida International Univ., Miami. Drinking Water Quality Research Center.
W. J. Cooper, L. M. Meyer, C. C. Bofill, and E. Cordal.
IN: Water Chlorination: Environmental Impact and Helath Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 285-296, 8 fig, 1 tab, 15 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, Chlorine demand, Bromides, Chlorinated hydrocarbons, Trihalomethanes, Organic matter.

The effect of bromide on trihalomethane (THM) formation was studied at four levels of added bromide (0.008, 0.08, 0.8, and 8.0 mg/liter) and four levels of added chlorine (8.35, 16.7, 25.1, and 33.4 mg/liter). Water used in the experiments was lower Florida peninsula groundwater with 6 mg/liter total organic carbon and 50 units of color. The presence of bromide significantly affected the formation and distribution of THMs. The chloroform concentration differed only slightly between the natural groundwater and bromide-augmented groundwater at the lower two bromide levels (at all levels of added chlorine) indicating that a minimum bromide concentration is necessary to influence chloroform formation. However, at the higher bromide concentrations chloroform concentration decreased significantly. The effect of bromide on CHC12Br formation was also minimal at the two lowest bromides levels. At 0.8 mg/liter bromide the CHC12Br level increased; at 8.0 mg/liter bromide, its formation was retarded. Formation of CHC1Br2 and bromoform increased with added bromide, but the relationships were not linear. The total concentration of THMs formed was not influenced greatly by bromide addition. (Cassar-PTT)
W86-02155

FORMATION OF BROMINATED TRIHALOMETHANES: EXTENT AND KINETICS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. P. Gould, L. E. Fitchhorn, and E. Urheim.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 297-310, 7 fig, 2 tab, 8 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, Bromination, Trihalomethanes, 2,46-Trihydroxyacetopheonone, Organic compounds, Chlorine demand, Kinetics, Chemical reactions, Model studies.

A bromine incorporation factor was used to examine trends in the extent and rate of formation of brominated trihalomethanes (THMs). This factor represents bromination as a single quantitative measure, greatly simplifying the interpretation of data on the concentrations of the four THMs (CHC13, CHC12Br, CHC1Br2, and CHBr3). Phloroacetophenone (2,4,6-trihydroxyacetophenone) was selected as the model precursor. The degree of bromine incorporation was dependent on the initial characteristics of the reaction system (pH, bromide concentration, HOC1 concentration, precursor concentration) but largely independent of time. An extension of an empirical model developed by Kavanaugh for chloroform was also used to study the kinetics of individual THM formation. On the basis of this mode, bromination kinetics were substantially faster than chlorination kinetics. These studies show that a conclusive model for THM formation kinetics cannot be developed until the complete mechanism of THM formation has been fully explained. (Cassar-PTT)
W86-02156

BROMOFORM PRODUCTION IN TROPICAL OPEN-OCEAN WATERS: OCEAN THERMAL ENERGY CONVERSION CHLORINATION,
California Univ., Berkeley. Lawrence Berkeley Lab.
E. O. Hartwig, and R. Valentine.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 311-330, 6 fig, 7 tab, 22 ref. W-7405-eng-48.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, Bromoform, Trihaomethanes, Chlorine demand, Organic matter, Ocean Thermal Energy Conversion process, Hawaii, Cooling water, Evaportation discharge, Condensers, Seawater.

Formation of bromoform and other volatile organics during chlorination of evaporator and condenser seawater used for the Ocean Thermal Energy Conversion process is reported. Bromoform was the major halogenated organic compound produced as a result of chlorinating seawater at chlorine doses less than 1 mg/liter. Significantly greater quantities of bromoform were produced in evaporator water than in the condenser water as a function of total residual oxidant in both chlorinated and dechlorinated (with sodium thiosulfate) stored samples. No immediate bromoform production was detected in the dechlorinated condenser water, but 1-2 micrograms/liter was immediately produced in dechlorinated evaporator water. The difference in bromoform concentrations of dechlorinated evaporator and condenser water was related to water quality. Mean values for pH and total organic carbon (micrograms/liter) for evaporator water were 8.27 and 1.17; for condenser water, 7.64 and 0.758. Evaporator water temperature was about 25 degrees C; condenser water 5.6 degrees C. Daily potential bromoform production by this plant with a mixed discharge of 34.9 million liters/hour, 0.2 mg total residual oxidant/liter, and 2 hours of chlorination per day equals 1.3 billion micrograms. Considering a 20-fold dilution within 2 hours, the bromoform concentration of the discharge water would be 0.93 micrograms/liter. (Cassar-PTT)
W86-02157

DISPERSION OF CHLORINE AT SEVEN SOUTHERN CALIFORNIA COASTAL GENERATING STATIONS,
Southern California Edison Co., Rosemead.
R. S. Grove.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 333-346, 5 fig, 3 tab, 6 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Cooling water, Powerplants, Southern California Edison Company, Seawater.

The fate of chlorine in powerplant cooling systems and the dispersion of chlorine in receiving waters were monitored at seven coastal generating stations of the Southern California Edison Company. Remarkable variability was observed in chlorine injection concentrations, condenser outlet concentrations, outfall concentrations, and dissipation rates among the generating stations. Less variability was seen within surveys done at the same generating station. No patterns of chlorination could be discerned among the data except for one station with a rigorous chlorine control program. Chlorine levels were below the detectable limit of 0.08 mg/liter at over half of the plant outfalls. The surveys also showed that a much higher level of coordinated chlorine assessment work is necessary to fully characterize factors controlling chlorine release to the environment. These factors, which are site-specific, include (1) seasonal varability in water chlorine demand and slime growth in condenser tubes, (2) chlorine demand of piping and conduits beyond the condensers, (3) influence of macrofouling control heat treatment methods on chlorine demand, and (4) scouring effect of silty water on condenser tubes. (Cassar-PTT)
W86-02158

MODEL FOR PREDICTING CHLORINE CONCENTRATION WITHIN MARINE COOLING CIRCUITS AND ITS DISSIPATION AT OUTFALLS,
Central Electricity Generating Board, Fawley (England). Marine Biological Unit.
M. H. Davis, and J. Coughlan.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 347-257, 5 fig, 1 tab, 18 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Cooling water, Chlorine demand, Model studies, Seawwater, Powerplants.

A model for predicting the behavior of chlorine in powerplant cooling systems using seawater differs from previous models in two ways: (1) it supposes an exponential, rather than a hyperbolic decay and (2) it accomodates discrete rate constants for the discharged and receiving waters. Temperatures decrease only slightly in discharge canals, allowing a high decay rate. Dilution is responsible for the most significant decreases in temperature and chlorine concentration. Simulations show that the chlorine loss curve generated by serial dilutions is steeper than the theoretical dilution curve, even when allowance is made for continuing decay. This is partially explained by the additional chlorine demand introduced with the diluting water. Instantaneous chlorine demand is higher at open-coast sites than at estuarine sites. The decay curve of chlorinated samples, from open-coast sites, regenerates a breakpoint curve which is out of phase with the original. The decay of estuarine samples does not regenerate a pronounced breakpoint. (Cassar-PTT)
W86-02159

WATER CHLORINATION PROGRAMS AT ONTARIO HYDRO FOSSIL-FIRED GENERATING STATIONS,
Ontario Hydro, Toronto.
F. Butler, R. Kozopas, G. T. Haymes, and J. S. Griffiths.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 359-372, 6 fig, 3 tab, 4 ref.

Descriptors: *Fate of pollutants, *Water pollution effects, *Chlorination, *Fish, *Cooling water, Rainbow smelt, Smelt, Fish eggs, Eggs, Larvae, Lambton Generating Station, Lakeview Generating Station, R.L. Hearn Generating Station, Powerplants, Toxicity.

A chlorination regimen for controlling biofouling has been developed for Ontario Hydro's Lambton Thermal Generating Station. Normal maintenance chlorine dose is 0.19 kg/min for 20 min, twice a week. To combat excessive biofouling, shock chlorination in stages up to 900 kg/day for 30 min is used. During chlorination, adult fish (white bass and suckers) show an avoidance response at chlo-

rine concentrations below reported lethal concentrations. This response involves increased activity toward areas of reduced chlorine concentraion. Chlorine plume studies at three coal-fired stations outline the limited use zones for each area. In all cases no chlorine is detected at a depth greater than 3 m outside the influence of the jet stream from the outfall channel. During the chlorine studies a three-electrode continuous, on-line, automatic chlorine analyzer was developed. In a study of the effects of shock chlorination on fish eggs and fry, chlorine concentrations below 0.1 mg/liter (the maximum expected in discharges) have little effect on rainbow smelt eggs or larvae. Survival rates dropped raipdly as the temperature rises to 20 degrees C. (Cassar-PTT)
W86-02160

HALOGENATED ORGANIC STUDY AT SELECTED TENNESSEE VALLEY AUTHORITY FOSSIL-FUELED POWER PLANTS,
Tennessee Valley Authority, Chattanooga.
C. V. Seaman, L. O. Hill, B. W. Vignon, T. B. Stanford, and M. D. Hunter.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 373-382, 4 fig, 3 tab, 6 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, Organic compounds, *Cooling water, Trihalomethanes, Chloroform, Organic compounds, Tennessee Valley Authority, Powerplants.

Water samples were collected for organic analysis at the intake, outlet, and several points throughout the cooling systems of three Tennessee Valley Authority fossil-fueled steam plants. Chloroform was detected at each plant more than 90% of the time. Highest concentration detected was 18.0 mg/liter. Other volatile halogenated organics detected were bromodichloromethane, dibromochloromethane, 1,2-dichloroethane, trans-1,2-dichloroethylen, methylene chloride, and 1,1,1-trichloroethane. Semivolatile halogenated organics detected were 1-chloronaphthalene, 2-chlorophenol, and 1,2-dichlorobenzene. Comparison of inlet and outlet samples showed that outlet chloroform concentrations had a positive linear relationship with chlorine dose and a negative relationship with nitrogen species. The substrate was correlated significantly with chloroform concentration only when the effects of chlorine dosage were removed. Temperature was not apparently correlated with chloroform levels. However, combining the data across plants for the outlet location and removing the effects of other precursors showed a significant relationship. This suggested that temperature influences on chloroform concentrations were masked by effects of other variables. Likewise, the effects of chlorine demand and cooling water flow rate on chloroform production are masked. (Cassar-PTT)
W86-02161

ORGANOHALOGENS IN CHLORINATED COOLING WATERS DISCHARGED FROM NUCLEAR POWER STATIONS,
Battelle Pacific Northwest Labs., Richland, WA.
R. M. Bean, D. C. Mann, and D. A. Neitzel.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 383-390, 4 tab, 8 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Cooling water, Powerplants, Trihalomethanes, Phenols, Organic componds, Chlorinated hydrocarbons, Aromatic compounds, Nuclear powerplants.

Formation of organhalogens, particularly phenolic compounds, during biocide treatment of cooling water was studied at three nuclear powerplants. Chloroform concentrations in the discharges were 0.5 to 1.1 micrgrograms/liter; CHBrC12, 0.7-1.0 micrograms/liter; CHBr2C1, 0.3-0.9 micrograms/liter; and bromoform, 0.1-3.7 micrograms/liter. Concentrations of major phenolic compounds (in micrograms/liter) in chlorinated cooling waters were 2,4,6-trichlorophenol, 0.7; bromodichlorophenol, 0.5; dibromochlorophenol, 0.3; 2,4,6-tribromophenol, 0.4; and dibromodichlorophenol, 0.1. The highest total level of halogenated phenolic compounds at any station was 1.4 micrograms / liter. Conditions favoring the concentrations, longer chlorine residence time, higher bromine concentrations in intake water, low volatility, and presence of the biocide, which prevents biodegradation. In contrast, trihalomethanes tend to be released to the atmosphere in cooling towers. In once-through systems trihalomethanes were predominant.
W86-02162

ATMOSPHERIC EMISSIONS FROM ELECTRIC POWER PLANT COOLING SYSTEMS,
SRI International, Menlo Park, CA.
J. H. Smith, J. C. Harper, and B. C. DaRos.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 391-404, 8 fig, 3 tab, 6 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Chlorination, *Cooling water, Organic compounds, Trihalomethanes, Powerplants, Air pollution, Chlorinated hydrocarbons.

Concentrations of volatile halogentated compounds were determined in recirculation water systems and in the tower drift of three powerplants. Maximum concentrations (micrograms/liter) observed in up to 8 separate tests during chlorination of recirculation water were as follows: chloroform, 14.5; bromodichloromethane, 3.1; chlorodibromomethane, 3.3; bromoform, 2.9; trichloroethylene, 1.1; tetrachloroethylene, 0.1; and chloramines, 1.6. In general, chloroform concentrations in the tower basin were 20-30% lower than concentrations in the tower riser, suggesting that the towers strip some of the volatiles during one pass through the tower. Concentrations of volatiles (micrograms/liter) in the tower drift, using several different methods, were chloroform, 0.0002-0.81; trichloroethylene, trace to 0.48; tetrachloroethylene, trace to 1.73; p-dichlorobenzene, 0.07-0.27; and p-chlorotoluene, 0.42-1.45. The sampling techniques for the drift were not considered efficient. (Cassar-PTT)
W86-02163

HYDROGEN PEROXIDE - A REAL ALTERNATIVE TO CHLORINE IN WATER TREATMENT,
North Surrey Water Co., Staines (England).
E. R. Gardiner, N. J. Hobbs, and J. Jeffery.
IN: Water Chlorination: Environmental Impact and Health Effect; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 405-419, 8 fig, 5 tab, 16 ref.

Descriptors: *Fate of pollutants, *Water treatment, *Disinfection, *Hydrogen peroxide, Oxidation, Thames River, Trihalomethanes, Organic compounds, Chlorinated hydrocarbons.

Hydrogen peroxide and a low prechlorine dose reduce the trihalomethane (THM) formation at the prechlorination stage, but high postchlorination still yields high THM values. Hydrogen peroxide cannot be a complete replacement for prechlorination because it would not always achieve complete disinfection and would be difficult to monitor. Hydrogen peroxide with a low prechlorine dose achieves lower plate counts at 22 and 37 degrees C than chlorine alone. In the absence of free chlorine there is a lower value for THM formation in the presence of hydrogen peroxide. The coagulation treatment achieves an appreciable reduction in the potential THM formation. This work was carried out on actual river water samples that were variable. (Author)
W86-02164

BROAD-SPECTRUM ANALYSIS OF THE REMOVAL OF TRACE ORGANICS IN AN OZONE-GRANULAR ACTIVATED CARBON POTABLE-WATER PILOT PLANT STUDY,
Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
G. T. Coyle, S. W. Maloney, J. Gibs, and I. H. Suffet.
IN: Water Chlorination: Environmental Imp and Health Effects; Volume 4, Book 1: Chemi and Water Treatment, Ann Arbor Science, A Arbor, MI. 1981. p 421-443, 11 fig, 3 tab, 19 CR806256-02.

Descriptors: *Fate of pollutants, *Pollutant ide fication, *Activated carbon, *Ozonation, Disin tion, Pilot plants, Adsorption, Water treatm Temperature effects, Gas chromatography, Org ic compounds.

Capillary gas chromatograms of 200-300 pe were compared using chi-square continge tables in a study of effluents from a granular a vated carbon water treatment pilot plant. Bef contacting the carbon, the water (from the D ware River at Philadelphia, Pa.) was treated clarification, rapid sand filtration, ozonation, ozone dissipation. The anlaytical methods w devised to determine the significant difference p= 0.05 of chromatograms of (1) influent vs. ef ent composite samples, (2) influent vs. effluents the activated carbon columns, (3) location of tr organics on columns, and (4) effects of differen in water temperature on trace organics remo The following conclusions were drawn. Replic carbon contactors had reproducible effluent chromatogram profiles. Influents to the colu were variable in weeks 3-5, after which they w homogeneous (weeks 6-13). Effluents for week 11.5 were homogeneous. Effluents were differ at the different temperatures. At week 9 core sa ples from the carbon columns showed differen between warm and cooled water. Chlorinated ganics were observed in the influent to the carb columns and on the surface of the carbon. chlorinated organics were found in the efflue during the 18-week study. (Cassar-PTT)
W86-02165

INFLUENCE OF PRECHLORINATION ON THE AMOUNT AND TOXICITY OF MICR POLLUTANTS EXTRACTED FROM WAT AT THE MORSANG PLANT,
Societe Lyonnaise des Eaux et de l'Eclairage, Pa (France).
F. Fiessinger, R. Cabridenc, I. Chouroulinkov, E Festy, and P. Lazar.
IN: Water Chlorination: Environmental Imp and Health Effects; Volume 4, Book 1: Chemis and Water Treatment, Ann Arbor Science, A Arbor, MI. 1983. p 467-481, 4 fig, 5 tab, 6 r

Descriptors: *Fate of pollutants, *Water treatme *Chlorination, *Activated carbon, *Organic co pounds, Adsorption, Morsang, France, Toxici Clarification.

Studies of the Morsang, France, water treatm plant from 1977 to 1980 concerned organic poll ants and the roles of prechlorination and granu activated carbon adsorption. The following co clusions were reached. (1) Prechlorination creased the intrinsic toxicity and hindered redu tion of the amount of extracted pollutants in t finished water. Overall activity of the extra (intrinsic toxicity times relative amount) was duced by 50% with prechlorination and 85% wi out prechlorination. (2) Activated carbon appli at low doses did not influence short-term toxic but seemed to reduce long-term toxicity. In cases it enhanced the reduction of the weight extract in the finished water. (3) Clarification (c agulation + flocculation + sedimentation + sa filtration) reduced the extract weight but increas its intrinsic toxicity. Clarification preferentially moved the less harmful substances. (Cassar-PT
W86-02168

FORMATION OF ORGANOHALOGEN COM POUNDS IN CHLORINATED SECONDAR WASTEWATER EFFLUENT,
Florida International Univ., Miami. Drinki Water Quality Research Center.
W. J. Cooper, J. T. Villate, E. M. Ott, R. A. Slifker, and F. Z. Parsons.
IN: Water Chlorination: Environmental Impa and Health Effects; Volume 4, Book 1: Chemist

and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 483-497, 3 fig, 9 tab, 6 ref. 80-034.

Descriptors: *Fate of pollutants, *Wastewater treatment, *Chlorination, Trihalomethanes, Chlorinated hydrocarbons, Brominated hydrocarbons, Organic compounds, Goulds-Perrine Treatment Plant, Virginia Key Treatment Plant, Florida.

The effects of chlorinating wastewater effluents was studied at several Miami, Florida, secondary treatment plants. Chloroform and brominated trihalomethanes were formed before and after the chlorination breakpoint. The concentration of individual trihalomethanes tended to follow the breakpoint curve; lower concentrations were found near the breakpoint. Bromides were present in wastewater from the Virginia Key plant, a result of sea water intrusion into the collection system. A clear trend in the rate of trihalomethane formation with respect to chlorine added was not obtained. (Cassar-PTT)
W86-02169

NONVOLATILE ORGANICS IN DISINFECTED WASTEWATER EFFLUENTS: CHEMICAL CHARACTERIZATION,
Oak Ridge National Lab., TN.
L. L. Jolley, R. B. Cumming, N. E. Lee, L. R. Lewis, and J. E. Thompson.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 499-523, 4 fig, 2 tab, 25 ref. EPA-IAG-D7-01027.

Descriptors: *Fate of pollutants, *Wastewater treatment, *Disinfection, *Organic compounds, Chlorination, Ozonation, Ultraviolet radiation, Toxicity, Mutagens, Chromatography, Oxidation.

Disinfection of secondary and tertiary effluents by chlorination destroyed some nonvolatile organic constituents and produced others in the majority of samples examined. Mutagenicity of certain fractions was similarly affected. Ozonation both destroyed and produced some nonvolatile organic compounds, including those showing mutagenic activity. Ultraviolet radiation had a definite but slight effect on nonvolatile organic constituents; it decreased mutagenicity in some effluents and increased it in others. Chemical composition and mutagenicity varied with plant and the date sampled. A total of 106 nonvolatile compounds were identified in the concentrates of control and disinfected effluents. The mutagenic fraction contained 0 constituents; the nonmutagenic fraction, 65. Twenty-nine constituents were found in both mutagenic and nonmutagenic fractions. No known mutagens were identified in the mutagenic fractions from undisinfected, chlorinated, ozonated, and ultraviolet-irradiated effluents. Phosphate identified in the chromatographic fractions was attributed to degradation during trimethylsilylation or anion exchange preparation. (Cassar-PTT)
W86-02170

FORMATION OF VOLATILE HALOORGANIC COMPOUNDS IN THE CHLORINATION OF MUNICIPAL LANDFILL LEACHATES,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
P. Gould, R. E. Ramsey, M. Giabbai, and F. G. Ohland.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 525-539, 5 fig, 5 tab, 31 ref. A-8-GA.

Descriptors: *Fate of pollutants, *Wastewater treatment, *Chlorination, *Leachates, *Landfills, Organic compounds, Trihalomethanes.

Leachate, obtained from a simulated landfill lysimeter, was chlorinated at doses up to 600 mg/liter chlorine. The landfill consisted of codisposed metal plating sludge and municipal solid waste. The leachate on day 697 after landfilling had a COD of 4791 mg/liter and BOD of 2150 mg/liter. The chlorine demand curve showed a sharp rise in chlorine residual at about 500 mg/liter chlorine dose. A leachate with initial COD of 4875 mg/liter showed increasing COD removal up to about 28% at the maximum chlorine dose of 600 mg/liter. Organisms were not fully removed (8000/ml remaining) even at the 400 mg/liter chlorine dose. Chlorination of the leachate produced a complex mixture of volatile haloorganic compounds, only one of which (methylene chloride) was found in the unchlorinated leachate. Among the products were 1-chloro-4-methylbenzene; chlorobenzene; 2-chloroethylbenzene; benzonitrile; trihalomethanes; halogenated ethanes, propanes, butanes, and heptanes; ketones; halogenated aromatics; and a number of unknown compounds. Until further data are collected, hypochlorous acid should be used cautiously as a disinfectant for landfill leachates. (Cassar-PTT)
W86-02171

NEW APPROACHES TO THE PRODUCTION OF 36 CL-LABELED CHLORINATING AGENTS AND THE MEASUREMENT OF 36CL INCORPORATED INTO BIOLOGICAL MATERIALS,
Florida Univ., Gainesville. Dept. of Food Science and Human Nutrition.
For primary bibliographic entry see Field 5A.
W86-02172

HAZARDOUS WASTE MANAGEMENT FOR THE 80'S.
For primary bibliographic entry see Field 5E.
W86-02219

ENVIRONMENTAL 'TERMITE' INSPECTIONS,
For primary bibliographic entry see Field 5A.
W86-02223

GROUND-WATER MONITORING AT AN INDUSTRIAL WASTE DISPOSAL SITE IN PENNSYLVANIA,
N. L. Circhowicz, R. M. Cadwgan, and J. R. Ryan.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI, 1982. p 389-402, 8 fig.

Descriptors: *Waste disposal, *Groundwater pollution, *Geohydrology, Groundwater, Groundwater movement, Industrial wastes, Benzenes, Environment, On-site investigations, Water analysis.

A two-phase hydrogeologic investigation was carried out at a former industrial waste disposal site in Pennsylvania. Coal-coking sludge, agricultural chemical residue, and desulfurization waste are among the wastes disposed of in trenches at the 35 acre site, located on the tip of a river island. The purpose of Phase I of the study was to determine a preliminary estimate for the discharge rate of organic contaminants to the river via ground water. This was achieved by using data on the flow and quality of groundwater collected at 46 locations beneath, and adjacent to, the site. Benzene was found to be the dominant compound, showing a discharge rate of about 2 lb/day into the river from groundwater. Phase II was designed to better define the hydraulic gradient by continuously monitoring ground and river water levels. The hydraulic gradient of the water table was found to be typically toward the river, and over a two-month period, during low-flow conditions, averaged 0.0015. The direction of groundwater flow was toward the site for approximately six days during the same two-month period at a maximum gradient of 0.0058. (Halterman-PTT)
W86-02231

CASE HISTORIES OF GROUNDWATER ASSESSMENT,
Burgess and Niple Ltd., Columbus, OH.
J. A. Barker-Stonerock.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, I, 1982. p 403-420, 2 fig, 6 tab.

Descriptors: *Groundwater pollution, *Waste disposal, *Industrial wastes, *Landfills, Environment, On-site investigations, Groundwater movement, Water quality, Water sampling, Water analysis.

Case histories of groundwater assessment performed for a variety of purposes (assessment for landfill development, for abandoned landfill, and for surface impoundments) are presented. Groundwater assessments typically include the following: a review of existing water quality data to determine local groundwater quality; performance of test borings and laboratory testing on earth materials obtained during drilling; installation of monitoring wells at those locations where geologic and groundwater conditions indicate the best information may be obtained; estimation of rate of groundwater movement based on transmissivities; collection of water samples from completed monitor wells and analysis in laboratory for specified parameters; and preparation of final report to determine whether additional testing is required. The case histories presented illustrate the need for tailoring the study techniques to meet the individual requirements of each disposal site. (Halterman-PTT)
W86-02232

CHLORINATED DIOXINS AND DIBENZOFURANS IN THE TOTAL ENVIRONMENT,
For primary bibliographic entry see Field 5A.
W86-02233

2,3,7,8-TETRACHLORODIBENZO-P-DOXIN AND 2,3,7,8-TETRACHLORODIBENZOFURAN RESIDUES IN GREAT LAKES COMMERCIAL AND SPORT FISH,
Health and Welfare Canada, Ottawa (Ontario).
J. J. Ryan, P-Y. Lau, J. C. Pilon, and D. Lewis.
IN: Chlorinated Dioxins and Dibenzofurans in the Total Environment, Butterworth Publishers, Boston, 1983. p 87-97, 1 fig, 4 tab, 10 ref.

Descriptors: *Chlorinated hydrocarbons, *Hydrocarbons, *Chlorinated dioxins, *Chlorinated dibenzofurans, Chemical Analysis, Gas chromatography, Chromatography, Mass spectrometry, Public health, Ecosystems, Ecology, *Great Lakes, *Fish.

Residues of 2,3,7,8-tetrachlorodibenzo-p-dioxin (tetra-CDD)and 2,3,7,8-tetrachlorodibenzofuran (tetra-CDF) were studied in commercial fish and sportfish in the Great Lakes, primarily Lake Ontario, during 1979 and 1980. For the samples with positive results, tetra-CDD ranged from 2.0 to 38.5 ppt, with catfish, eel and smelt having the highest levels. The levels of tera-CDF ranged from 3.2 to 200 ppt, with smelt, salmon and rainbow trout having the highest concentrations. Overall, 25% of the 62 fish sampled had concentrations of these compounds greater than 10 ppt. The highest concentrations were associated with high polychlorinated biphenyls and lipid content of the fish. (Halterman-PTT)
W86-02234

OCCURRENCE OF TETRACHLORODIBENZO-P-DIOXIN IN ENVIRONMENTAL SAMPLES FROM SOUTHWEST MISSOURI,
Environmental Protection Agency, Kansas City, MO. Region VII.
For primary bibliographic entry see Field 5A.
W86-02236

CHLORINATED DIOXINS AND DIBENZOFURANS IN THE TOTAL ENVIRONMENT II.
For primary bibliographic entry see Field 5A.
W86-02240

HISTORICAL RECORD OF POLYCHLORINATED DIOXINS AND FURANS IN LAKE HURON SEDIMENTS,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
For primary bibliographic entry see Field 5A.
W86-02241

ANALYSIS OF PCDD-PCDF IN ENVIRONMENTAL SAMPLES,
Department of the Environment, Ottawa (Ontario).
For primary bibliographic entry see Field 5A.
W86-02242

OCTANOL-WATER PARTITION COEFFICIENT OF 1,3,6,8-TCDD AND OCDD BY REVERSE PHASE HPLC,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
For primary bibliographic entry see Field 5A.
W86-02243

BIOAVAILABILITY OF 14C-1,3,6,8-TETRACHLORODIBENZO-P-DIOXIN AND 14C-OCTACHLORODIBENZO-P-DIOXIN TO AQUATIC INSECTS IN SEDIMENT AND WATER,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. C. G. Muir, B. E. Townsend, and G. R. B. Webster.
IN: Chlorinated Dioxins & Dibenzofurans in the Total Environment II, Butterworth Publishers, Boston, 1985. p 89-102, 3 fig, 4 tab, 28 ref.

Descriptors: *Chlorinated hydrocarbons, *Aquactic insects, *Hydrocarbons, *Biological magnification, Polychlorinated dibenzo-p-dioxins, Ecosystems, Aquatic environment, Insects, 1,3,6,8-tetrachlorodibenzo-p-dioxins, Ocatachlorodibenzo-p-dioxin.

The uptake, elimination and bioconcentration of 1,3,6,8-tetrachlorodibenzo-p-dioxin (1,3,6,8-TCDD) and octachlorodibenzo-p-dioxin (OCDD) by five species of aquatic insect were compared in the laboratory in two types of sediment. The purpose was to assess how bioavailability of polychlorinated dioxins (PCDD) in aquatic systems could be influenced by the physical properties of the chemicals, the characteristics of the physical environment, and the characteristics of the animals. Total radioactivity in each animal, and water concentrations of radioactive 1,3,6,8-TCDD abd OCDD were determined using liquid scintillation counting, and bioconcentration factors for each chemical and aquatic insect were calculated from 96 hr. exposure data. Bioconcentration of 1,3,6,8-TCDD and OCDD by aquatic insects was much less than predicted, possibly due to overestimation of the concentration present in water in a bioavailable form. OCDD was poorly accumulated by all animals studied (possibly due to strong sorption to sediment and to poor absroption due to steric factors). The differences in the bioconcentration factors among the various insects studied are discussed in relation to differences in feeding habits and metabolism. The results confirm that PCDD other than 2,3,7,8-TCDD can be mobilized by sediment-dwelling animals. (Halterman-PTT)
W86-02244

PART PER TRILLION RESIDUES OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN MICHIGAN FISH,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
S. W. Kaczmar, M. J. Zabik, and F. M. D'Itri.
IN: Chlorinated Dioxins & Dibenzofurans in the Total Environment II, Butterworth Publishers, Boston, 1985. p 103-124, 7 fig, 2 tab, 11 ref.

Descriptors: *Chlorinated hydrocarbons, *Fish, *Carp, *Sucker, *Hydrocarbons, Polychlorinated dibenzo-p-dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin, Ecosystems, Aquatic environment, Michigan.

A study was carried out to determine whether 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) residues exist in selected Michigan fish samples in areas other than the previously-sampled Tittabawassee River watershed. Samples of carp (Cyprinus carpio) and sucker (Carostomus commersoni) were collected by electroshock at 31 sampling sites in the lower peninsula of Michigan. Samples were extracted, purified, then analyzed for 2,3,7,8-TCDD by gas chromatography-mass spectrometry (with a detection limit of 20 picograms). Detectable residues of 2,3,7,8-TCDD ranged from 17 to 586 ng/kg. Residues of 2,3,7,8-TCDD were detected in fish collected upstream to the chlrophenol manufacturing facility in Midland, and from other portions of the state in entirely different watersheds. The results suggest that low-level contamination of bottom-feeding fishes is relatively widespread in the industrialized portions of the state. (Halterman-PTT)
W86-02245

PCB'S: HUMAN AND ENVIRONMENTAL HAZARDS,
Butterworth Publishers, Boston. 1983. Edited by Frank M. D'Itri and Michael A. Kamrin. 443 p.

Descriptors: *Polychlorinated biphenyls, *Public health, *Social aspects, *Chemical analysis, Great Lakes, Political aspects, Water analysis, Monitoring, Toxicity, Fish.

Polychlorinated biphenyls (PCBs) have been used for industrial purposes for over 50 years. Research on the ecology and human health impact of these compounds has, however, been conducted only since 1966. This volume presents varied viewpoints on the hazard of these compounds, the latest research findings, and an overview of the steps that are being taken to solve PCB-related problems in the environment, with an emphasis on the Great Lakes region. The volume stresses five major aspects fo PCBs: (1) background, scientific, social and political information that is important to understand the PCB contamination problem; (2) the current state of the art with respect to chemical analysis and monitoring; (3) information on the metabolism, biotransformation, toxicology and persistence of PCBs; (4) effects of PCBs on human health; and (5) the roles of Federal and state agencies in the regulation of PCBs. (Halterman-PTT)
W86-02248

PCB PROBLEM: AN OVERVIEW,
Michigan State Univ., East Lansing.
J. E. Cantlon.
IN: PCB's: Human and Environmental Hazards, Butterworth Publishers, Boston, 1983. p 5-10.

Descriptors: *Polychlorinated biphenyls, *Public health, *Social aspects, *Chemical analysis, Great Lakes, Political aspects, Water analysis, Monitoring, Toxicity, Fish.

The global contamination of the environment with organics began with the burgeoning of industrial chemistry between World Wars I and II and picked up substantially both in diversity of hazardous materials and in the tonages that were released into the earth's hydrosphere, atmosphere, lithosphere, and biosphere after World War II. The halogentated hydrocarbons were manufactured for various kinds of industrial uses, including pesticides, inks, cutting oils, and heat exchange fluids. Among these hydrocarbons are the polychlorinated biphenyls (PCBs), which now appear in the tissues of most living organisms as well as in air, water, soils, and sediments over most of the earth. The Great Lakes have been a particularly interesting contamination area, with substantial food-chain concentrations of these highly fat-soluble compounds. While the manufacture of PCBs is now prohibited in the United States, the size of the environmental burden in waters, sediments, soils, disposal sites, and in deployed transformers and other containers of PCBs is very large, estimated to be 82 million kg. Several observations on these processes are offered. First, research results that bear on urgent decisions rarely have the luxury of science's normal process. Second, decision-makers are often subject to strong public pressures, predominantly from one side or the other, in arriving at their decisions. Third, on occasion, one organization holds both developmental and regulatory responsibilities. (Halterman-PTT)
W86-02249

OVERVIEW OF THE SCIENTIFIC BASIS FOR CONCERN WITH POLYCHLORINATED BIPHENYLS IN THE GREAT LAKES,
Amsterdam Univ. (Netherlands). Vakgroep Aquatische Oecologie.
W. R. Swain.
IN: PCB's: Human and Environmental Hazar
Butterworth Publishers, Boston, 1983. p 11-48
fig, 8 tab, 56 ref.

Descriptors: *Polychlorinated biphenyls, *Pub
health, *Social aspects, *Chemical analysis, Gr
Lakes, Political aspects, Water analysis, Monit
ing, Toxicity, Fish.

The ubiquitous distribution of residue-forming x
obiotic substances, particularly organochlori
compounds, including polychlorinated biphen
(PCBs) is rapidly becoming apparent. Widespre
dissemination is suggested by a variety of studies
areas presumably remote from the direct industr
and/or cultural influences attributable to man,
cluding melting snow in the Antarctic, mammals
the Artic, in the surface waters and atmosphe
above the Sargasso Sea, and inthe sediments
Siberian Lake Baikal. Although a number of the
compounds have been banned, or their use h
been severely restricted, they are still routine
reported in the Great Lakes basin. The identi
characteristics of PCBs which made them indust
ally desirable, also makes them persist and accum
late in the environment. They are resistant to ac
base reactions, hydrolysis, chemical oxidatio
photodegradation, thermal changes, and m
chemical agents. Furthermore, they bond tightly
particulate matter such as soils and sediments; th
have 8-15 year half-lives; they are extremely sol
ble in oils and fats, thus they tend to partition in
biologic tissue. Several reasons for the particul
susceptibility of the Great Lakes to PCBs a
listed, and an extensive literature review of data
PCBs observed in fish of the Great Lakes is pr
vided. Various aspects of human health hazar
pertaining to PCBs are discussed, including t
possiblity of PCBs persisting in the human popul
tion for as long as 5 to 8 generations into t
future. (Halterman-PTT)
W86-02250

**PCBS IN THE GREAT LAKES: SOURCE
SINKS, BURDENS,**
Minnesota Univ., Minneapolis. Dept. of Civil a
Mineral Engineering.
S. J. Eisenreich, and T. C. Johnson.
IN: PCB's: Human and Environmental Hazard
Butterworth Publishers, Boston, 1983. p 49-75,
fig, 10 tab, 55 ref. R805172-01 R806084-01.

Descriptors: *Polychlorinated biphenyls, *Gre
Lakes, *Distribution patterns, *Ecological distrib
tion, Distribution reservoirs, Chemical analys
Water analysis, Monitoring, Sediment-water inte
faces, Interfaces, Mud-water interfaces, Air-wat
interfaces.

Information on the polychlorinated biphen
(PCB) sources, sinks, and burdens in the Gre
Lakes is summarized. A mass balance model
described which provides an understanding of th
transport and distribution of PCBs in the lakes a
an estimate of the residence time that they rema
in the ecosystem, or in any compartment. Th
compartments include the atmosphere, hydros
pere, sediments, and lithosphere. The atmosphe
does not represent a significant reservoir of PC
in the Great Lakes, but appears to be a majo
pathway of input into the hydrosphere. Sediment
however, are the ultimate sink for PCBs in th
Great Lakes. The lower lakes, especially Erie an
Ontario, have the highest concentrations, rangin
from 50-60 ng/g. The Upper Great Lakes exhib
ranges of concentrations from 3 to 10 ng/g. Th
upper 0.5 cm of sediment appears to have th
highest concentrations within the lakes. The PC
burden for all the Great Lakes combined wa
estimated to be 417,000 kg in sediments, 25,000 k
87,000 kg in water, and 200 kg in the atmosphere
The principal sources of PCBs to the Great Lake
are atmospheric deposition, tributary input, an
municipal/industrial discharges. Considerable u
certainty still exists in estimating fluxes at air
water and sediment/water interfaces. (Halterma
PTT)
W86-02251

NVIRONMENTALIST'S VIEW OF THE PCBS N THE GREAT LAKES,
ichigan United Conservation Clubs, Lansing.
L. Washington.
I: PCB's: Human and Environmental Hazards, tterworth Publisers, Boston, 1983. p 101-108, 9 f.

escriptors: *Polychlorinated biphenyls, *Public alth, *Social aspects, *Chemical analysis, Great kes, Political aspects, Water analysis, Monitor-g, Toxicity, Fish.

e non-scientific perspective of the concerns of men for the problems of polychlorinated bi-enyls (PCBs) in the Great Lakes is presented. CBs in the Great Lakes are particularly impor-t for Michigan anglers. Although the salmon hery, for example, is expanding, and is important the tourist industry and to local anglers who nsume large quantities of fish annually, there is le information of PCB levels in fish made avail-e to the public. The public health hazards re-rding contaminated fish are reviewed. The need a vastly improved information base on PCBs l other contaminants in the Great Lakes envi-nment, and an improved delivery system, to get t information to the general public, is called for. lterman-PTT)
6-02252

IBLE TISSUE SAMPLING FOR FISH CON-MINANT ANALYSIS,
chigan Dept. of Natural Resources, Lansing. face Water Quality Div.
E. McCracken.
PCB's: Human and Environmental Hazards, terworth Publishers, Boston, 1983. p 123-139, 1 2 tab, 22 ref.

scriptors: *Polychlorinated biphenyls, *Public lth, *Social aspects, *Chemical analysis, Great es, Political aspects, Water analysis, Monitor-Toxicity, Fish, Michigan.

nsiderable controversy exists over which hod of preparation is best when fish are to be lyzed for contaminants such as polychlorinated henyls (PCBs). The state of Michigan's reason-on this issue is discussed, along with Michi-'s current fish contaminant monitoring pro-n. The objectives of the program are to pro-e information for assessing potential human ex-ure to contaminants from consumption of fish; letermine chronological trends in fish contami-ts; to identify new residues in fish: to communi-the results of these findings to appropriate ernment agencies; and to inform the public of lic health advisories. The inconsistencies within eral and state testing programs are discussed, the manner in which Michigan proposes to lve the question are outlined. The proposed includes the determination of a standard le portion which is specific for each species; the analysis of that portion of raw fish which ld most likely be eaten after cooking. The ous categories for testing include skin-on fillet such fish as perch, walleye, basses, crappie and ishes; skin-off fillet for catfish, pike, whitefish, trout; and headless, gutted common-sense ap-ch to fish contaminant sampling when the ctive is to determine amounts of consumable taminants present in fish. (Halterman-PTT)
5-02253

TRANSFORMATION AND PERSISTENCE POLYCHLORINATED BIPHENYLS (PCBS) FISH,
lical Coll. of Wisconsin, Inc., Milwaukee. t. of Pharmacology and Toxicology.
Lech, and R. E. Peterson.
PCB's: Human and Environmental Hazards, erworth Publishers, Boston, 1983. p 187-201, 9 14 ref. ES-01080 (JJL).

criptors: *Polychlorinated biphenyls, *Public th, *Chemical analysis, Great Lakes, Water ysis, Monitoring, Toxicity, Fish.

ilable data indicate that most fish species bio-form the lower chlorinated polychlorinated biphenyl (PCB) congeners at slower rates than mammals. Generally, the overall residue patterns in fish resemble the patterns found in the exposure source. Furthermore, the degree of bioaccumulation of PCBs in fish may be directly related to the fat content of the species in question, and that the major mechanism for reducing PCB concentrations in fish is by dilution by growth, rather than by true elimination of a portion of the total body burden. (Halterman-PTT)
W86-02255

SALINITY IN WATERCOURSES AND RESERVOIRS,
Proceedings of the 1983 International Symposium on State-of-the-Art Control of Salinity. July 13-15, 1983, Salt Lake City, Utah. Butterworth Publishers, Boston. 1984. 622 p. Edited by Richard H. French.

Descriptors: *Salinity, *Saline water, *Groundwater, *Water quality, Irrigation, Water pollution, Dissolved solids, Percolation, Environmental effects, Agriculture, Economic aspects, Legal aspects.

A series of papers pertaining to salinity in watercourses and reservoirs is presented. Specific topics include salinity control policy and planning, salinity sources and problems, salinity data base analysis, modeling applied to salinity problems, salinity control programs in agriculture, non-agricultural salinity control programs, alternative uses of saline water, geochemical and geophysical methods of salinity detection, salinity control project mitigation, and secondary salinization. (Halterman-PTT)
W86-02264

COLORADO RIVER SALINITY - THE USER'S PERSPECTIVE,
Colorado River Board of California, Los Angeles.
M. B. Holburt.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 13-22.

Descriptors: *Colorado River, *Saline water, *Salinity, Irrigation, Flood irrigation, Irrigation practices, Water requirements, Irrigation requirements, Water softening, Water supply, Water use, Water users.

The concern over the Colorado River's comparatively high salt concentration is discussed. Of particular interest is the major economic detriments to both agricultural and urban water users in the lower Basin states (Arizona, California, Nevada) and northwestern Mexico. Steps to control the salinity, begun in 1929 and continuing to the present, are outlined. Measures to reduce the impact of salinity on urban and agricultural areas are discussed. Methods include the use of water softeners by domestic and commercial users, use of corrosion-resistant plumbing, installation of drain pipes in farm fields to carry away the salt, and the lining of laterals with concrete to decrease seepage. (Halterman-PTT)
W86-02265

PROBLEM OF SALINITY AND ITS CONTROL, RIVER MURRAY, AUSTRALIA,
River Murray Commission, Canberra (Australia).
T. A. O'Brien.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 33-42, 4 fig, 1 tab.

Descriptors: *Saline water, *Salinity, Water requirements, Water supply, Water use, Water users, River Murray, *Australia, Monitoring, Water quality management.

The problems of salinity in south-eastern Australia, with emphasis on the River Murray, are described. There are three types of problems discussed: the salinity of water diverted from the river and applied to crops; the salinisation of irrigated land caused by the development of high water tables; and, the salinisation of dry land. The problems which could be common to rivers which form the border between states, or countries, are highlighted. The continued viability of the River Murray, and its importance to Australia, and the priority of government funding are discussed. (Halterman-PTT)
W86-02267

SALINITY SOURCES AND PROBLEMS OF THE DANUBE RIVER BASIN,
North Dakota State Univ., Fargo. Dept. of Soil Science.
A. Maianu.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 105-114, 2 fig, 4 tab, 12 ref.

Descriptors: *Saline water, *Salinity, Irrigation, Water requirements, Water supply, Water users, Groundwater, *Danube River.

Various aspects of the salinity problems of the Danube River Basin are discussed. The primary source of salts is the weathering of tertiary, crystalline, volcanic and cretaceous rocks in the river basin in Czechoslovakia, Austria, Hungary, Yugoslavia, Romania, and the USSR. The salts are then carried to the Danube by surface and ground waters. The composition and concentrations of salts in surface and ground waters are summarized. The hazards of secondary salinization resulting from irrigation are discussed. (Halterman-PTT)
W86-02273

SOUTHWESTERN SALINITY SITUATION: THE ROCKIES TO THE MISSISSIPPI,
Army Engineer Div. Southwestern, Dallas, TX.
B. G. Rought.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 115-124, 2 fig, 4 ref.

Descriptors: *Saline water, *Salinity, Water requirements, Water users, Water use, Groundwater, Red River, Colorado River, Texas, Brazos River, Arkansas River, Pecos River, Desalination.

An overview of the salinity problem in the streams of the southwestern United States, from the Continental Divide to the Mississippi River, is presented. The quality of water in the mainstreams of a number of the river systems in this area is seriously degraded by salt emissions from major salt sources in the upper portion of their basins. Environmental and economic impacts of the salinity, including crop loss, increased municipal water treatment costs, and corrosion damage, are discussed. Potential solutions that are outlined include: importing fresh water, desalination, freshwater diversion, impoundment, and collection and disposal of brine. (Halterman-PTT)
W86-02274

ECONOMIC EVALUATION OF SALINITY CONTROL,
Corps of Engineers, Tulsa, OK.
For primary bibliographic entry see Field 6B.
W86-02275

NATURAL SALT POLLUTION CONTROL BRAZOS RIVER BASIN, TEXAS,
Army Engineer District, Fort Worth, TX.
J. A. McCrory.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 135-144, 6 fig, 3 ref.

Descriptors: *Saline water, *Salinity, *Desalination, Water requirements, Water users, Water use, Brazos River, Texas, Economic aspects.

Salt pollution from salt flats in the headwaters of the Brazos River has resulted in poor water quality in approximately 1500 kilometers of the main stem Brazos River from Stonewall County, Texas, to the Gulf of Mexico. The principal mineral pollutants considered in this study were chlorides, sulfates, and total dissolved solids. Various plans to control salinity in the Brazos River, including desalination, pipeline to the Gulf, and redistribution of existing water sources, are discussed. It appears

that desalination by impoundment evaporation techniques presents the most cost effective solution. (Halterman-PTT)
W86-02276

SALINITY BALANCE OF THE LOWER VIRGIN RIVER BASIN, NEVADA AND ARIZONA,
Montana Univ., Missoula. Dept. of Geology.
W. W. Woessner, M. D. Mifflin, R. H. French, A. Elzeftawy, and D. E. Zimmerman.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 145-156, 2 fig, 1 tab, 15 ref.

Descriptors: *Salinity, *Saline water, *Phreatophytes, Groundwater, Total dissolved solids, Virgin River, Nevada, Arizona, Monitoring, Water use, Water users, Water pollution sources.

This 12 month study developed additional hydrologic data for the development of salinity budgets in the Lower Virgin River Valley, Nevada and Arizona, a tributary of the Colorado River. Monthly stream gaging at six locations, groundwater monitoring at existing and new sites, water-quality sampling and soil sampling were included. Results indicate a complex hydrologic system with concentration, storage, and transport of salt occurring iin the study area. Water and salt budget analyses indicate a 36% net loss of water and a 34% net loss in salt for a 61 km reach of river. The majority of water loss is attributed to phreatophyte consumptive use. Salt concentration associated with phreatophyte comsumptive use exceeded consumptive concentration of salt by agriculture and direct evaporation by 2.6 times. Data indicate that phreatophyte areas play a major role in salt accumulation and storage by consumptively utilizing 2.1 to 3.6 m of water per year. TDS concentrations of 5,800 to 11,000 mg/l were measured in the shallow groundwater underlying phreatophyte areas. (Author)
W86-02277

GRAND VALLEY SALT PICK-UP CALCULATIONS,
Bureau of Reclamation, Grand Junction, CO.
R. R. Inman, D. C. Olson, and D. L. King.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 157-167, 2 fig, 4 tab, 2 ref.

Descriptors: *Salinity, Saline waters, Groundwater, Total dissolved solids, Monitoring, Water use, Grand Valley, *Colorado, *Colorado River, Water pollution sources.

The quantification of salt loading from the Grand Valley in western Colorado, based on an analysis of an inflow-outflow river budget, is presented. The Grand Valley contributes approximately 6 percent of the average salt loading to the Colorado River. An average salt pickup of 528 million kg/yr was determined through analysis of salt and water budgets over a 29 year period. A 95 percent confidence limit on the mean of + or - 84 million kg/yr was established. No significant trend in salt pickup was identified. The Colorado-Utah State Line gage was determined to be the most appropriate gage for estimating the Colorado River outflow. Outflows were adjusted so that the unaccounted flow was zero, which provided a better estimate of salt pickup. (Halterman-PTT)
W86-02278

IMPACT OF RESERVOIRS ON SEASONAL AND HISTORICAL SALINITY OF THE COLORADO RIVER,
Bureau of Reclamation, Salt Lake City, UT.
D. P. Trueman, and J. B. Miller.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 171-180, 4 fig, 3 tab, 9 ref.

Descriptors: *Saline water, *Salinity, Water requirements, Water users, Groundwater, *Colorado River, Desalination, Reservoirs, Multipurpose reservoirs.

The historical perspective of water resources development is presented and the impacts of reservoirs on salinity and the salinity control are evaluated. The increased development of reservoirs over the last several decades has resulted in an increased retention time of Colorado River water to the range of 4-6 years. This retention time has decreased both the seasonal and annual variability of salinity in the basin. Predicted increased discharges will effectively dilute the salinity in the lower basin. Future development, however, in the upper basin, will eventually reduce the flow through the system and cause increased salinity levels. (Halterman-PTT)
W86-02279

HISTORICAL TRENDS IN CONCENTRATION AND LOAD OF MAJOR IONS IN THE COLORADO RIVER SYSTEMS,
Bureau of Reclamation, Denver, CO.
D. K. Mueller, and C. D. Moody.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 181-192, 4 fig, 1 tab, 10 ref.

Descriptors: *Salinity, *Saline water, Model studies, *Colorado River, Water pollution, Solids, Discharge measurements.

A data base development procedure which allows maximum use of existing data to determine reasonable estimates of monthly mean solute concentrations, loads, and mass fractions is described. The data analysis included a regression of seasonal values. Interpretation of results of such analyses is based on several general observations, including: differences between regulated and unregulated sites are clearly seen; significant mean value differences are easier to identify than temporal trends in monthly data; trends are more easily identified for low flow periods, probably due to smaller variance in discharge data; changes in concentration, load and mass fraction are associated with river discharge; several dependent variables appear for solute changes; and no single dependent variable is clearly preferable for identification of changes or trends. (Halterman-PTT)
W86-02280

EFFECT OF ASSUMPTIONS ON MODEL CALIBRATION AND PREDICTION,
Utah Water Research Lab., Logan.
E. K. Israelsen.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 195-201.

Descriptors: *Salinity, *Saline water, *Model studies, Agriculture, Groundwater, Mathematical models, Water pollution sources.

Background information on mathematical descriptions of processes and functions, computer algorithms, and model applications precede a discussion of the effects of assumptions on calibrations and predictive capability of models. Several alternative assumptions used in models concerning salinity are presented, and the subsequent variability in the results is demonstrated. The belief is stated that models will not indicate all the problems of fitting to the real system or any indication of feedback impacts. Furthermore, since models will not indicate all problems, they sometimes make predictions that are not correct, but the model links all the processes together so that the impacts of one process on another show up most of the time. Finally, although models are superior to single process calculations, they are not yet perfect and are subject to making errors as directed by the modeler. (Halterman-PTT)
W86-02281

LONGITUDINAL-VERTICAL HYDRODYNAMICS AND TRANSPORT WITH CHEMICAL EQUILIBRIA FOR LAKE POWELL AND LAKE MEAD,
Edinger (J.E.) Associates, Inc., Wayne, PA.
J. E. Edinger, E. M. Buchak, and D. H. Merritt.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston, 1984. p 213-222, 5 fig, 1 tab, 6 ref.

Descriptors: *Salinity, *Saline water, *Water p
lution sources, Model studies, Lake Powell, L
Mead, Colorado River, Carbonates, Imperial D
Reservoir operation.

The hydrodynamic features and numerical prop
ties of the LARM longitudinal and vertical hyd
dynamic and transport model are presented and
use in Lakes Powell and Mead are discussed. T
model produces extensive, detailed results incl
ing outflow conditions, evaporation rates and
tailed circulation patterns for Lake Powell. T
use of the model to construct carbonate chemis
in Lake Mead is also described. Data show t
there are gypsum sources along the reservoir t
can add calcium and sulfate to the system and a
the carbonate balance. Future uses of the model
the Bureau of Reclamation, for assessing lo
range impacts of Lake Mead and Lake Powell
the Colorado River system, are described. This
important because projections of future salin
increases and requirements for salinity control
presently based upon the assumption that the re
voirs exert no change on salinity other than c
centration by evaporation. (Halterman-PTT)
W86-02283

**CONCEPTUAL MODELS OF GEOLOGIC A
AGRICULTURAL SALT LOADS IN STREA
OF THE UPPER COLORADO RIVER BAS**
Utah Water Research Lab., Logan.
C. J. Duffy.
IN: Salinity in Watercourses and Reservoirs, B
terworth Publishers, Boston. 1984. p 223-233, 4 f
5 ref.

Descriptors: *Saline water, *Salinity, *Irrigati
Modeling studies, Colorado River, Groundwat
Furrow irrigation, Irrigation effects, Environm
tal effects, Irrigation engineering, Irrigation pr
tice.

Some specific aspects of the interaction and mixi
of groundwater from near surface saline strata, a
infiltration of water and solutes from irrigation
discussed. Subsurface transport in unconsolidat
strata is modeled and salt transport in consolidat
rocks is described. Preliminary calculations sugg
that diffusion from consolidated sediments m
contribute significant salinity to groundwater a
streams in the region. Little is known, howev
about the magnitude of diffusion coefficient, t
effective porosity, and the concentration contr
between unconsolidated strata, all of which cont
the magnitude of this salinity source. Future
search, including the exploration of the potential
diffusive salt loading, possibly a major factor
effective salinity control, is also discussed. (Halt
man-PTT)
W86-02284

**SALINITY CONTROL PROBLEMS ASSOCIA
ED WITH IRRIGATION IN SOUTH-WES
NEW SOUTH WALES, AUSTRALIA,**
Water Resources Commission of New Sou
Wales, Sydney (Australia).
A. van der Lelij, and S. E. Flint.
IN: Salinity in Watercourses and Reservoirs, Bu
terworth Publishers, Boston. 1984. p 265-274, 2 f
1 tab, 3 ref.

Descriptors: *Salinity, *Saline water, *Water po
lution sources, Groundwater, Irrigation, Irrigati
effects, Irrigation practices, Environmental effec
Economic aspects, Agricultural hydrology, Ag
culture.

In common with irrigation in many other semi-ar
regions, irrigation schemes on the Riverine Plain
south-west New South Wales have resulted in ris
in ground water levels which have created pro
lems of soil salinization and waterlogging. T
raised ground water levels can also lead to sa
intrusion into streams and impairment of wat
quality if they are not controlled. Subsurface drai
age presents problems of disposal of saline drainag
effluent without increasing the salinity of water
unacceptable levels for downstream users. A rang
of effluent management options are to be evaluate
to achieve the target salinity of 0.4 g/L at th
downstream end of the system. These includ

reuse of effluent upstream by discharge to, and dilution in, supply channels (limited scope because effluent salinity is often too high); dilution flows to reduce salinity downstream; diversion of the more saline winter drainage flows; on-farm retention of effluent during the irrigation season; disposal of some effluent in evaporation areas. (Halterman-PTT)
W86-02288

CASE STUDY OF A SALINITY CONTROL PROGRAM, VINTA BASIN, UTAH,
Soil Conservation Service, Salt Lake City, UT.
For primary bibliographic entry see Field 5G.
W86-02289

CHARACTERISTICS, TRENDS AND SURFACE WATER QUALITY IMPLICATIONS OF SALINE TILE EFFLUENT,
D. B. Harker.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 325-334, 4 fig, 14 ref.

Descriptors: *Salinity, *Saline water, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agriculture, Agricultural hydrology, Alberta, Canada, Saskatchewan River Basin.

The possible negative impact of future saline tile effluent on river water quality within Alberta, Canada is being studied. A network of on-farm tile drainage outlets has been regularly monitored for the past six years - to establish effluent quantities, qualities and apparent trends. Based on general trends, tile drainage is not expected to severely impact on river water quality within the foreseeable future. Some short-term negative impact may occur during periods of extremely low river flow, however. Long-term chemical data from individual sites has annual cycles and multi-year trends otherwise masked by site averaging. Such information indicates that site-specific data could be critical to accurately project seasonal and long-term effluent impact on small receiving systems. (Author)
W86-02294

MEEKER DOME SALINITY INVESTIGATION,
CH2M Hill Central, Inc., Denver, CO.
C. F. Feast.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 359-365, 3 fig, 1 tab, 3 ref.

Descriptors: *Saline water, *Salinity, *Water pollution sources, *Water quality control, Groundwater, Water supply, Environmental effects, Well hydraulics, Economic aspects, White River, Colorado, Saline aquifers.

Following the drilling of exploratory oil wells, saline water rose through uncased bore holes and recharged an unsaturated aquifer. This led to a drastic increase in salt loading into the nearby White River. Prior to the drilling, the salt load of the White River was 4.5 million kg per year; after drilling, salt loading reached a high of 24 million kg per year. Immediately following cementing of the bore holes, water in the upper aquifer began falling rapidly. An 80% decrease in salt loading to the White River was observed within one year of plugging the wells. On the basis of the reduction in salt loading, the program has had a benefit-to-cost ratio of 5 to 1. This ratio is expected to increase if the saline flows continue to decrease. (Halterman-PTT)
W86-02297

PRICE/SAN RAFAEL RIVER BASINS SALINITY INVESTIGATION,
CH2M/Hill, Boise, ID.
D. A. Johnson, and J. A. Riley.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 407-416, 1 fig, 1 ref.

Descriptors: *Saline water, *Salinity, *Water pollution sources, *Water quality control, Model studies, Groundwater, Water supply, Irrigation, Monitoring, Water use, Cooling water.

Investigations into the agriculture-related contribution of salt to the San Rafael and Price River Basins are discussed. The study approach consisted of analysis of existing data, development of hypotheses concerning salt loading mechanisms, collection of field data to verify quantities and sources of salinity, and formulation and analysis of viable alternatives. Results of the investigations indicate that the most cost effective options include a combined plan for on-farm irrigation improvements and winter water system improvements; collecting and using the drainwater for cooling, using binary cooling tower technology; and, collecting and using the drainwater to develop tar sands. The need for additional research to confirm yields from irrigation drains, to demonstrate the use of saline wqter in binary cooling towers, to refine the use of saline waters in tar sand development, to develop mitigation plans, to refine on-farm efficiencies, and to understand groundwater interactions is stressed. (Halterman-PTT)
W86-02302

STUDY OF SALINITY PRODUCTION FROM WILDLANDS OF PRICE RIVER BASIN, UTAH,
Unitex Corp., Salt Lake City, UT.
A. Lin.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 417-426, 4 fig, 3 tab, 6 ref. YA553-CTI-1064.

Descriptors: *Salinity, *Saline water, Shales, Gypsum, Watersheds, Ephemeral streams, Intermittent streams, Price River Basin, Utah.

Some essential results of a study of salinity production from wildlands are described. The major soluble mineral in Mancos shale is gypsum, with varying quantities of other sulfate minerals. For overland flows, solute pick-up increases as sediment concentration increases and as hill slope increases. Heavy solute pick-up in channels is a function of proximity to Mancos shale. Saline crust accumulations constitute a major source of salts to storm runoff and the estimated storm-related salt load contributed from wildlands ranged from 1% to 50%. The study confirms the importance of hillslope erosion in sediment and salinity production of the study area. (Halterman-PTT)
W86-02303

GEOCHEMICAL IDENTIFICATION OF SALINITY SOURCES,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 5A.
W86-02309

DETECTION OF SUBSURFACE SALINITY WITHIN THE NORTHERN SLOPES REGION OF VICTORIA, AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 7B.
W86-02310

CHEMICAL REACTIONS INFLUENCING SALINITY INCREASE OF SOIL AND GROUNDWATERS IN THE GREAT BASIN, WESTERN UNITED STATES,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 2K.
W86-02311

ANALYSIS OF SALT YIELDS ASSOCIATED WITH THE CONSTRUCTION AND OPERATION OF PARIETTE DRAW WILDLIFE AREA, UTAH,
Bureau of Land Management, Denver, CO.
For primary bibliographic entry see Field 4C.
W86-02313

SECONDARY SALINIZATION OF WATER RESOURCES IN SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
For primary bibliographic entry see Field 4C.
W86-02315

SALINITY CONTROL PROBLEMS: NON-AGRICULTURAL,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
D. F. Peterson.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 583-592.

Descriptors: *Salinity, *Saline water, Groundwater, Water pollution, Seepage control, Seeps, Environmental effects, Groundwater movement.

A summary and critique of fifteen papers, concerning non-agricultural issues of salinity control, is presented. The topics of the papers fall into three categories: salinity sources and problems, salinity control programs, and salinity control project mitigation. 'Salinity sources' covers the Danube Basin and the southwestern United States. 'Salinity control programs' focuses on the Colorado River, Smokey Hill River in Kansas, the Red and Arkansas Rivers, and the general problems of 'produced' water in Kansas. Salinity control project mitigation focuses on a variety of problems in Arizona, California, Montana, and Australia. Technology, economic analyses, and institutionalization, as they relate to salinity control, are discussed. (Halterman-PTT)
W86-02316

CRITIQUE - SALINITY CONTROL PROBLEMS: AGRICULTURAL,
Science and Education Administration, Fort Collins, CO. Agricultural Research.
M. E. Jensen.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 597-608, 2 tab.

Descriptors: *Salinity, *Saline water, Groundwater, Water pollution, Seepage control, Seeps, Environmental effects, Groundwater movement, Agriculture, Agriculture watersheds.

Several papers pertaining to salinity control are reviewed and critiqued. Areas such as upstream vs. downstream users, long-term indicators of emerging problems, barriers to implementing control measures, the role of irrigated agriculture, water consumption by flood plain vegetation, and salt removal are reviewed. Possible distribution of river basin water costs is explored, and specific examples are provided for illustration of the concept. (Halterman-PTT)
W86-02317

SOURCE MOVEMENT AND EFFECTS OF NITROGEN AND PHOSPHORUS IN THE HEADWATERS OF HOP BROOK, MARLBOROUGH, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
J. C. Briggs, and W. D. Silvey.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4017, 1984. 5 p, 3 fig, 17 tab, 25 ref.

Descriptors: *Water quality, *Ponds, *Nutrients, Eutrophication, Algal growth, Nitrogen phosphorus, Hager Pond, Grist Millpond, Carding Millpond, Hop Brook, *Massachusetts.

The headwaters of Hop Brook near Marlborough, Massachusetts, contain a series of three in-line ponds--Hager Pond, Brist Millpond, and Carding Millpond--which receive over half of their surface-water inflow as effluent from the Marlborough Easterly Wastewater Treatment Plant. These ponds have a history of summer algal blooms and fish kills. Water entering these ponds contains quantities of nitrogen and phosphorus far higher than the levels known to promote excessive growth of aquatic vegetation. As the water moves

through the three ponds, nitrogen levels decrease. Although some nitrogen is lost to the atmosphere by denitrification, the bulk of the nitrogen probably is retained in the pond sediments. There is a net decrease in phosphorus in the water leaving Carding Millpond compared to the water entering Hager Pond. However, during most sampling periods, the phosphorus concentration of water leaving Carding Millpond is still above the level known to cause excessive growth of aquatic vegetation in lakes. During certain summer periods, there appears to be release of some phosphorus from the sediments in Carding and Grist Millponds. No improvement in water quality of the three ponds can be expected until the concentrations of nutrients entering Hager Pond are reduced to levels that will not support excessive growth of aquatic vegetation. (USGS)
W86-02343

QUALITY AND QUANTITY OF URBAN RUNOFF AND ATMOSPHERIC DEPOSITION IN URBAN AREAS OF SALT LAKE COUNTY, UTAH, 1980-1981,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. C. Christensen, D. W. Stephens, G. E. Pyper, H. F. McCormack, and J. F. Weigel.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4011, 1984. 223 p, 11 fig, 36 tab, 22 ref.

Descriptors: *Urban hydrology, *Utah, *Urban runoff, *Organic pollutants, Sediment composition, Salt Lake County, *Atmospheric deposition, Storm characteristics, Salt Lake County.

Water of good quality from mountain streams is degraded as it moves through urban areas to the Jordan River in Salt Lake County, Utah. The impact of urban runoff and atmospheric deposition on the quality of water in those streams and in storm conduits and canals functioning as storm drains was evaluated using data collected during 1980-81. Atmospheric-wetfall loads for an average storm were as much as 10 pounds per acre for total solids, but the dissolved trace metals were generally present in insignificant quantities. Wetfall-deposition loads generally were greater than storm-runoff loads, indicating that a large quantity of the wetfall load remained as soil deposits. Acid rain fell in more than one-half of the storms sampled, most commonly in September and October. Dustfall concentrations reflected the composition of local soils, particularly with regard to iron, manganese, and chromium; but concentrations of cadmium, copper, lead, zinc, and chloride were considerably enriched. Monthly loads of dryfall solids reached a maximum of 62 pounds per acre in the Little Cottonwood Creek urban basin, but were of the same magnitude as total storm loads for a heavy rainfall. Urban runoff represented about 38 percent of the discharge in three canals. The water in the canals was poorer in quality than the water in the mountain streams. The impact of the canal discharges to the streams is slight, however, owing to their 'relatively small amounts.' Concentrations of sediment, suspended solids, suspended trace metals, phosphorus, and oxygen-demanding substances were much greater during storm runoff than under base-flow conditions. This report contains data for basin and storm characteristics and water-quality information for atmospheric deposition and urban runoff. (USGS)
W86-02346

NUTRIENT AND DETRITUS TRANSPORT IN THE APALACHICOLA RIVER, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. D. Mattraw, and J. F. Elder.
Available from Dist Branch, USGS 604 S. Pickett St Alexandria, VA 22304. USGS Water-Supply Paper 2196-C, 1984. 62 p, 27 fig, 32 tab, 62 ref.

Descriptors: *Nutrients, *Detritus, *Floodplains, Flood discharge, Wetlands, Hydrologic budget, Organic matter, Carbon, Nitrogen, Phosphorus, Water quality, Baseline studies, Swamps, *Florida, *Wetlands, *Apalachicola River, *Nutrient transport, *River quality assessment.

The Apalachicola River in northwest Florida flows 172 kilometers from Jim Woodruff Dam to Apalachicola Bay on the Gulf of Mexico. Fifteen percent of the Apalachicola basin is occupied by a bottom-land hardwood floodplain that is relatively undeveloped. The dense floodplain forest produces approximately 800 metric tons per square kilometer of litter fall annually. Spring floods of March and April 1980 carried 35,000 tons of the decaying litter fall (detritus) into Apalachicola Bay. The estuary is predominantly a detrial-based food-web ecosystem which produces important commercial quantities of oyster, shrimp, blue crab, and various species of fish. Two hundred fourteen thousand metric tons of organic carbon were transported into the bay during the 1-year study period, June 1979 to June 1980. Nitrogen transport during the same period was 21.5 x 10 (to the third) tons and phosphorus was 1.7 x 10 (to the third) tons. The Apalachicola River floodplain contribution to the annual transport of carbon, nitrogen, and phosphorus was 34,200 tons, 668 tons, and 197 tons, respectively. Sixteen percent of the organic carbon is derived from less than 1 percent of the Apalachicola-Chattahoochee-Flint River basin. (USGS)
W86-02356

RAINFALL-RUNOFF RELATIONSHIPS AND WATER-QUALITY ASSESSMENT OF COON CREEK WATERSHED, ANOKA COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02370

HYDROGEOLOGY OF A LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02371

HYDROLOGY OF AREA 60, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, NEW MEXICO, COLORADO, UTAH, AND ARIZONA,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02382

LITERATURE REVIEW OF SURFACE-WATER QUALITY IN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
C. J. O. Childress.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-619, 1984. 30 p, 6 fig, 2 tab, 31 ref.

Descriptors: Streams, *Water quality, Literature review, Dissolved oxygen, Base flow, Storm runoff, Bed load, *Ohio, *Cuyahoga River basin, Cuyahoga Valley National Recreation Area.

The Cuyahoga Valley National Recreation Area in Ohio encompasses about 23 miles of the middle reach of the Cuyahoga River and parts of four major tributaries--Furnace Run, Brandywine Creek, Chippewa Creek, and Tinkers Creek. Water quality in this reach does not meet Ohio water-quality standards for dissolved oxygen, fecal bacteria, ammonia, and lead. Point sources and nonpoint sources of effluent contribute contaminants. On the basis of a review of scientific and technical literature, National Park Service management goals, and water-quality data collected recently by the U.S. Geological Survey, three subject areas in need of study have been identified: (1) the dissolved oxygen regime, (2) chemical quality of base flow and (3) quality of stormwater runoff. (USGS)
W86-02388

TIME OF TRAVEL, WATER QUALITY, AND BED-MATERIAL QUALITY FOR THE CUYAHOGA RIVER WITHIN THE CUYAH VALLEY NATIONAL RECREATION A OHIO,
Geological Survey, Columbus, OH. Water sources Div.
C. J. O. Childress.
Available from OFSS, USGS, Box 25425, wood, CO 80225. USGS Open-File Repor 4065, 1985. 49 p, 14 fig, 6 tab, 11 ref.

Descriptors: *Water quality, Biochemical ox demand, Dissolved oxygen, Coliforms, Strepto cus, *Traveltime, Dye releases, Trace elem *Bottom sediments, *Streams, *Path of pollu *Ohio, *Cuyahoga River, Cuyahoga Valley tional Recreation Area.

Three studies were conducted in the Cuya Valley National Recreation by the U. S. Geo cal Survey to (1) establish the relationship bet time of travel and discharge through the reach of the Cuyahoga River, (2) charact water quality of the Cuyahoga River within park over a 24-hour period, and (3) deter general areas where the streambed might be taminated by trace metals. Time of Travel bet Botzum and Independence is described by equation T = 46.9-0.038Q, where T = tim hours, and Q = discharge at Independenc cubic feet per second. On the main stem o Cuyahoga River, dissolved-oxygen saturation highest and ultimate carbonaceous biochem oxygen demand was lowest on the upstream downstream ends of the reach. Dissolved-ox saturation was more than 80 percent in all tributaries except Furnace Run, Brandy Creek, and Langes Run. The number of coliform counts per 100 milliliters of sample high throughout the study area and ranged fro to 1,200,000. Concentrations of all metals and metals investigated by means of analysis of material were not anomalously high. (USGS)
W86-02389

SELECTED HYDROLOGIC DATA FOR T SOUTH PLATTE RIVER THROUGH DENV COLORADO,
Geological Survey, Lakewood, CO. Water sources Div.
N. E. Spahr, S. R. Blakely, and S. E. Hammond
Available from OFSS, USGS, Box 25425, L wood, Co 80225. USGS Open-File Report 84- 1985. 225 p, 5 fig, 24 tab.

Descriptors: *Waste assimilative capacity, Rea tion, Traveltime, Water quality, *South Pl River, Denver, *Colorado, Water pollu sources, Urban hydrology.

The U.S. Geological Survey, in cooperation the cities of Littleton and Englewood, Color studied the effects of the discharge of treated e ent from the Bi-City Waste Water Treatment P on low-flow conditions of the South Platte Ri An 18-mile reach of the South Platte River, be ning below Chatfield Reservoir, through Denver metropolitan area was studied. Chatf Reservoir was used to regulate the flow of South Platte River on four occasions between tober 1982 and January 1984. Each flow-regula period was used to achieve a stable, low-f condition. Data collection during low flow lowed for the study of waste assimilation du both warm- and cold-water conditions. W quality, streamflow, channel geometry, travelti mixing-zone, reaeration, and benthic-oxy demand data were collected at selected instre tributary, and effluent sites. This report pres data collected during four periods of low f along the South Platte River. (USGS)
W86-02391

EFFECTS OF STORMWATER RUNOFF ON URBAN LAKE, LAKE ELLYN AT GL ELLYN, ILLINOIS,
Geological Survey, Urbana, IL. Water Resour Div.
R. G. Striegl.
Available from OFSS, USGS, Box 25425, La wood, CO 80225. USGS Open-File Report 84-6 1985. 19 p, 7 fig, 9 tab, 20 ref.

Descriptors: *Urban hydrology, *Storm runoff, *Detention storage, Trace metals, Sediment control, Limnology, Trap efficiency, *Runoff detention, *Illinois, Lake Ellyn.

Detention of urban runoff was observed to have physical, chemical, and biological effects on a small lake located near Chicago, Illinois. Accumulated bottom sediments reduce lake storage and have comparatively high concentrations of metals and organic compounds. Concentrations of many constituents dissolved in the lake water are seasonally cyclic, with annual concentration peaks occurring during the winter. Maintenance of desirable benthic invertebrate and fish communities, and development of undesirable phytoplankton blooms appear to be inhibited by sediments deposited on the lake bottom and suspended in the lake water. (USGS)
W86-02392

ALDICARB-PESTICIDE CONTAMINATION OF GROUND WATER IN EASTERN SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
J. Soren, and W. G. Stelz.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4251, 1984. 34 p, 7 fig, 4 tab, 26 ref.

Descriptors: *Water pollution sources, Groundwater quality, Geologic formations, Aquifers, *Hydrogeology, *Groundwater, Water pollution, *Pesticides, *New York, *Groundwater pollution, *Long Island, Eastern Suffolk County, *Aldicarb pesticide.

Aldicarb, a toxic oxime-carbamate pesticide that was believed incapable of reaching ground water, was used in potato-farming areas of eastern Suffolk County, New York during 1975-80. In 1979, aldicarb was found in substantial concentrations in ground water throughout the area. The New York State Department of Health set a limit of 7 micrograms per liter for aldicarb in drinking water. Extensive ground-water sampling into 1980 showed widespread contamination ranging from small amounts to as much as 515 micrograms per liter. In 1980, the U.S. Environmental Protection Agency banned the use of aldicarb on Long Island at the manufacturer's request. A 1982 sampling study found aldicarb to have penetrated to about 70 feet below the water table in concentrations ranging from below detection limit to 239 micrograms per liter. Despite reputed toxicity, no instance of aldicarb poisoning on Long Island has been documented. The excessive aldicarb concentrations in the ground water of eastern Long Island may persist for decades; the duration has not been precisely determined and remains under investigation. (USGS)
W86-02394

VOLATILE TRACE-ELEMENT CONCENTRATIONS IN SNOWMELT CONTRIBUTIONS TO STREAMS MONITORED BY HYDROLOGIC BENCH MARK NETWORK STATIONS IN THE CONTERMINOUS UNITED STATES WHERE AVERAGE ANNUAL SNOWFALL EXCEEDS 12 INCHES,
Geological Survey, Bismarck, ND. Water Resources Div.
J. L. Houghton, and L. Schimke.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4104, 1985. 19 p, 5 fig, 4 tab, 28 ref.

Descriptors: *Snowmelt, *Stream pollution, Trace metals, *Chemistry of precipitation, United States, *Hydrologic Benchmark Network.

Water-quality data collected for more than 10 years at 35 Hydrologic Bench-Mark Network stream stations in the snowbelt of the conterminous United States where average annual snowfall exceeds 12 inches were evaluated for evidence of trace-element enrichments during initial springtime snowmelt. Data for at least 1 initial snowmelt period are available at only 11 of these stations. Snowmelt enrichments in the concentrations of volatile trace elements, such as mercury, molybdenum, and selenium, ranged from 0 to 100 percent at stations in North Dakota and Montana. Enrichments in volatile trace-element concentrations were accompanied by pH decreases; and, therefore, pH decreases during snowmelt at other sites may indicate enrichment of volatile trace elements. Although enrichments of some of these trace elements exceeded 90 times their mean concentrations during nonsnowmelt periods, concentrations did not exceed drinking-water standards. However, concentrations of mercury in laboratory-simulated snowmelt exceeded drinking-water standards. (USGS)
W86-02397

DISTRIBUTION AND TRANSPORT OF TRACE SUBSTANCES IN THE SCHUYLKILL RIVER BASIN FROM BERNE TO PHILADELPHIA, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. K. Stamer, T. H. Yorke, and G. L. Pederson.
Available from Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2256-A, 1985. 45 p, 33 fig, 12 tab, 40 ref.

Descriptors: *Bottom sediments, *Trace elements, *Pesticide residues, *Probability distribution, Water quality standards, *Pennsylvania, *Schuylkill River, *Water pollution sources.

From October 1978 to March 1981, the U.S. Geological Survey assessed quality of Schuylkill River from Berne to the Fairmount Dam at Philadelphia, Pennsylvania. The assessment focused on the distribution and transport of trace metals and organic substances. In general, concentrations of trace metals and organic trace substances in the bottom sediments exceeded the background concentrations in the study area, and were greater in the main stem of the Schuylkill River than in its tributaries. Concentrations of most trace metals were lowest at Berne and highest in the urban-industrial Reading area. Concentrations generally decreased from Reading downstream to Philadelphia. Concentrations of chlordane, DDT and its metabolites, and dieldrin generally increased from Berne to Philadelphia, paralleling the increase in urban land use from Berne to Philadelphia. Transport of trace metals in the Schuylkill River is closely related to suspended-sediment transport. About 71 percent of the average annual transport of trace metals is in particular material. The frequency at which concentrations of copper, lead, and zinc in the Schuylkill River at Manayunk at Philadelphia are estimated to exceed domestic water-supply criteria of the U.S. Environmental Protection Agency is less than 1 percent of the time. (USGS)
W86-02410

5C. Effects Of Pollution

RELATIVE SENSITIVITY OF SEABIRD POPULATIONS IN ALASKA TO OIL POLLUTION,
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
D. J. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142091, Price codes: A02 in paper copy, A01 in microfiche. Technical Paper No3, August 1981, 15 p, 2 fig, 4 tab, 13 ref, append.

Descriptors: *Oil pollution, *Waterfowl, *Water birds, *Alaska, *Sensitivity analysis, Water pollution effects, Birds, Arctic Polar regions, Ecological effects, Oil spills.

The oil vulnerability index (OVI) developed by King and Sanger (1979) was used to identify sensitive species of birds in Alaska that could be affected by oil pollution. Many of the most common seabirds in Alaska and species endemic to the Bering Sea or the North Pacific are highly sensitive (a score of 70 or greater OVI) to oil pollution. The southern Bering, northern Bering, and the Chukchi Sea regions have over 80% of their major seabird colony populations rated highly sensitive. Within the Gulf of Alaska, the northwestern region and southwestern region have substantially larger populations of sensitive birds than the northeastern region. In general offshore oil and gas development in the Bering Sea poses a greater risk to seabird and waterfowl populations than would oil development in the Arctic Ocean or in the Gulf of Alaska. Oil and gas activities within the major foraging habitat of vulnerable populations in the Bering Sea represents the greatest concern to seabirds in Alaska. For most endemic waterfowl populations, the Yukon-Kuskokwim Delta represents the most important or critical habitat in Alaska. (Geiger-PTT)
W86-01975

PARAHO ENVIRONMENTAL DATA: BIBLIOGRAPHY,
Development Engineering, Inc., Rifle, CO.
For primary bibliographic entry see Field 10C.
W86-01983

TYPES OF POTENTIAL EFFECTS OF OFFSHORE OIL AND GAS DEVELOPMENT ON MARINE MAMMALS AND ENDANGERED SPECIES OF NORTHERN BERING, CHUKCHI, AND BEAUFORT SEAS,
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
C. J. Cowles, D. J. Hansen, and J. D. Hubbard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146142, Price codes: A02 in paper copy, A01 in microfiche. Technical Paper No9, December 1981. 23 p, 75 ref.

Descriptors: *Mammals, *Marine animals, *Offshore platforms, *Oil pollution, *Oil spills, Seals, Whales, Arctic, Polar regions, Marine plants, Ocean dumping, Water pollution effects, Natural gas, Water birds.

Direct effects of spilled oil to non-endangered marine mammals would vary depending on population density, physiological status, season, meteorological conditions, spill characteristics, duration of exposure and other factors. For many of the species occurring in Alaskan arctic areas, long-term, chronic, and direct or indirect effects associated with oil and gas development are of greater concern than the probability of widespread direct affects on seal populations. One possible result of low-level or chronic pollution would be to contribute to physiological stress on marine populations which may be at or near carrying capacity. Indirect effects of oil pollution on marine mammals would be those associated with changes in availability or suitability of various food sources or essential habitat factors. Mammalian species such as bearded seal or walrus may be most likely to show tropic-related effects in a specific locale since they rely on relatively sedentary benthic food sources. Shock waves and noise disturbance associated with offshore oil and gas development may alter the behavior of marine mammals. Other factors which may directly affect marine mammals include shoreline alteration, facility siting, dredging and filling, and secondary development. Potential factors affecting endangered cetaceans include direct and indirect oil and gas pollution effects, noise and disturbance effects and other factors such as marine disposal of drilling muds, formation waters, and cooling waters, shoreline alterations, and airborne noise. (Geiger-PTT)
W86-01986

ECOLOGICAL EFFECTS OF ACID PRECIPITATION,
Sigma Research, Inc., Richland, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-903148, Price codes: A05 in paper copy, A01 in microfiche. Proceedings of a Workshop held March 4-6, 1981, Atlanta, Georgia. EPRI-EA-2273, February 1982. 98 p, append. EPRI-WA 80-180.

Descriptors: *Acid rain, *Ecological effects, *Water pollution effects, *Air pollution, *Conferences, Acidic water, Ecosystems, Environmental

effects, Vegetation effects, Aquatic animals, Lime, Forest watersheds, Crop production, Fate of pollutants, Symposium.

The three-day workshop on Ecological Effects of Acid Precipitation was convened in Atlanta, Georgia, on March 4, 1981. This undertaking, sponsored jointly by the US Environmental Protection Agency (EPA) and the Electric Power Research Institute (EPRI), constituted the initial step in a series of planned, interactive efforts to enhance cooperation between individuals and agencies involved in acid precipitation research. The intent of the co-sponsors was to provide a forum for exchange concerning research directions being pursued by industry and government and to explore the need for coordination and integration of US studies - especially the ecosystem effects studies of EPRI and EPA. Approximately 85 active researchers, managers, and planners attended the workshop. These invited participants were drawn primarily from the fields of aquatic and terrestrial ecosystem research and included representatives from Canada, Norway, Sweden, and the United Kingdom. The workshop included presentations of program descriptions, a limited set of technical research efforts, and summaries of non-US programs in ecosystems studies. It culminated in a series of working group sessions that examined issues in aquatic systems, agricultural systems, natural terrestrial systems, and an overview of effects. Each working group considered outstanding research issues and identified critical areas where coordination and integration of research efforts could accelerate our understanding of the impacts of acid precipitation. (Author)
W86-02039

ENVIRONMENTAL AND ENGINEERING ASPECTS RELATED TO THE RESTORATION OF A FERROUS SULFATE (COPPERAS) WASTE DISPOSAL SITE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 5E.
W86-02117

WATER CHLORINATION PROGRAMS AT ONTARIO HYDRO FOSSIL-FIRED GENERATING STATIONS,
Ontario Hydro, Toronto.
For primary bibliographic entry see Field 5B.
W86-02160

PUBLIC HEALTH ASPECTS OF WATER SUPPLIES,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
A. W. Hoadley.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 17-36, 1 tab, 72 ref.

Descriptors: *Water treatment, *Drinking water, *Public health aspects, Potable water, Trace metals, Metals, Water analysis, Bacterial analysis, Salmonella, Shigella, Carcinogens.

Engineers involved in water supply must understand potential threats to the health of consumers, standards of quality with which to judge safety, and techniques for evaluating quality. Towards this end, several aspects of public health, related to water supplies are discussed. The most common waterborne infectious disease has been acute gastrointestinal illness. The waterborne bacterial pathogens Salmonella, Shigella, Escherichia coli, Yersinia enterocolitica, and Pseudomonas aeruginosa have all been implicated in major outbreaks of disease. The most common of the waterborne protozoan pathogens is Giardia lamblia. While outbreaks of waterborne Entamoeba hisolytica were reported in the United States prior to 1970, none have been reported since then. Viral diseases, such as hepatitis, are very serious matters with regard to water treatment, because very small numbers of viral particles appear to be capable of causing infection in man. The importance of trace metals in cardiovascular diseases and psychiatric disorders is discussed. Finally, the relationship between known carcinogens in drinking water supplies, and the incidence of various types of cancer is discussed. It appears that asbestos fibers, polynuclear aromatic hydrocarbons, chloroform, and carbon tetrachloride contamination in water has been related to cancers of the urinary organs and the gastrointestinal tract. (Halterman-PTT)
W86-02190

PCB'S: HUMAN AND ENVIRONMENTAL HAZARDS,
For primary bibliographic entry see Field 5B.
W86-02248

PCB PROBLEM: AN OVERVIEW,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 5B.
W86-02249

OVERVIEW OF THE SCIENTIFIC BASIS FOR CONCERN WITH POLYCHLORINATED BIPHENYLS IN THE GREAT LAKES,
Amsterdam Univ. (Netherlands). Vakgroep Aquatische Oecologie.
For primary bibliographic entry see Field 5B.
W86-02250

ENVIRONMENTALIST'S VIEW OF THE PCBS IN THE GREAT LAKES,
Michigan United Conservation Clubs, Lansing.
For primary bibliographic entry see Field 5B.
W86-02252

EDIBLE TISSUE SAMPLING FOR FISH CONTAMINANT ANALYSIS,
Michigan Dept. of Natural Resources, Lansing. Surface Water Quality Div.
For primary bibliographic entry see Field 5B.
W86-02253

ANALYSIS OF PCBS USING SPECIFIC ISOMER HIGH RESOLUTION CAPILLARY GAS CHROMATOGRAPHY,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
For primary bibliographic entry see Field 5A.
W86-02254

ECONOMIC IMPACTS OF PCB REGULATION IN FOOD FISH,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
D. R. Talhelm.
IN: PCB's: Human and Environmental Hazards, Butterworth Publishers, Boston, 1983. p 409-422, 1 fig, 3 tab, 3 ref.

Descriptors: *Polychlorinated biphenyls, *Public health, *Social aspects, *Chemical analysis, Great Lakes, Political aspects, Water analysis, Monitoring, Toxicity, Fish.

Following the Food and Drug Administration's (FDA) lowering of the allowable polychlorinated biphenyl (PCB) levels from 5 to 2 mg/kg in the edible portion of fish and shellfish, the National Fisheries Institute claimed that a $7-10 million per year food loss would result. A hearing addressing this issue was presented with data (from the National Marine Fisheries Service) on a large variety of commerically important fish, including whitefish, trout, carp, catfish, striped bass, bluefish, mackerel and lobster. The largest food loss would result from the lobster industry, estimated at $10 million. The total loss for all fish was estimated to be $14 million. The National Fisheries Institute, however, estimated the food loss to be $24 million. The hearing examiner found that the loss would be $13.5 million. However, several mistakes were apparently made, which resulted in errors within several fish categories. However, the total loss figures were similar to the original estimates of the FDA. (Halterman-PTT)
W86-02256

5D. Waste Treatment Processes

ACID MINE DRAINAGE: CONTROL A ABATEMENT RESEARCH,
Bureau of Mines, Pittsburgh, PA. Pittsburgh search Center.
A. G. Kim, B. S. Heisey, R. L. Kleinmann, and Deul.
Available from the National Technical Informat Service, Springfield, VA 22161 as PB83-140 Price codes: A02 in paper copy, A01 in microfi Report IC/8905, 1982, 22 p, 16 fig, 3 tab, 28

Descriptors: *Wastewater treatment, *Water q ity control, *Acid mine drainage, *Coal mi Pyrite, Oxidation, Sulfuric acid, Thiobacillus rooxidans, Drainage, Neutralization, Lime, Li stone, Sludge, Surfactants, Mine wastes, S banks.

Acid drainage from coal mines and refuse p results from oxidation of pyrite to form sulfi acid. As pH decreases, the pyrite-oxidizing activ of Thiobacillus ferrooxidans is promoted, furt increasing the pH. The Bureau of Mines is c ducting research to mitigate the impact of acid streams and aquifers. Mine sealing by flooding exclude oxygen, eliminating pyrite oxidati However, long-term sealing has often failed mines above drainage. Research on mine seal includes studies on more efficient and less exp sive seals, pneumatic stowing of limestone as a outcrop barrier stability, relief wells, and oxy diffusion in coal refuse piles. Developments treatment of acid mine drainage before discha into streams include a limestone neutralizat process which produces a denser sludge, the ef of activated carbon catalyst on particles, an low-cost treatment system for small acid-conta nated streams using artificial sphagnum moss limestone rubble. Methods for at-source contro acid mine drainage currently under investigat are bactericides to control limestone treatment freshly exposed pyrite, placement of sumps pumping systems, and control of groundwater tering mines. (Cassar-PTT)
W86-01978

FEEDWATER CLEANUP FOR COMBIN ELECTROLYSIS CATALYTIC EXCHANGE,
Monsanto Research Corp., Miamisburg, OH.
J. E. Lentz, J. Sienkiewics, and R. E. Ellis.
Available from the National Technical Informat Service, Springfield, VA 22161 as DE82-019 Price codes: A02 in paper copy, A01 in microfi Report MMM-2970; UC-70, Final Report. July 1982. 13 p, 1 fig, 7 tab. DE-AC04-76-DP000

Descriptors: *Wastewater treatment, *Orga compounds, *Oily water, Ion exchange, Activa carbon, Adsorption, Electrolysis catalytic change system, *Tritium, *Radioactive was Tritiated water.

A treatment process was developed for remov oil from tritiated wastewater from the combi electrolysis catalytic exchange system at Mound Facility, Miamisburg, Ohio. The pilot sc process comprised skimming of the oily layer, tering to remove particulates, absorbing solu organic material in three traps filled with mate such as activated carbon, filtering to rem carbon particles, and removing inorganic conta nates with ion exchange resin. If the treated wa was not satisfactory for feeding into the combi electrolysis catalytic exchange system, it was re cled for further treatment. Some inconsistencies organic removal were possibly a result of chann ing in the carbon beds. High flow rates tended produce better organic removal. Materials tested the traps were Witco activated carbons, Gra 940, 950, and 965, and three types of Amberlite exchange resins, XAD-7, XAD-4, and IRA-9 The ion exchange resins actually added orga matter to the water being treated. Of the activa carbons, Witco 950 was most effective in reduci organic levels. (Cassar-PTT)
W86-01980

PHYSICOCHEMICAL TREATMENT METHODS FOR OIL SHALE WASTEWATER: EVALUATION AS AIDS TO BIOOXIDATION,
California Univ., Berkeley. Lawrence Berkeley Lab.
B. M. Jones, R. H. Sakaji, and C. G. Daughton.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-020295, Price codes: A02 in paper copy, A01 in microfiche. Report LBL-14666, July 1982. 17 p, 8 fig, 43 ref. DE-AC03-76SF00098.

Descriptors: *Biological wastewater treatment, *Physicochemical treatment, *Biological oxidation, *Oxidation, *Oil waste, Activated carbon, Organic carbon, Wastewater treatment, Ozonation, Wastewater oxidation, Ultraviolet radiation, Mineralization, Sorption.

Biological treatment is usually effective for the mineralization of only one-half of the organic carbon present in retort waters. Several physicochemical treatment methods including sorption and chemical oxidation were evaluated for their ability to complement or enhance biooxidation. The use of spent shale or powdered activated carbon (PAC) effected preferential sorption of the less polar, biorefractory organic compounds from retort water. However, the concurrent application of these sorbents with biooxidation did no promote a synergistic removal. The construction and application of a pilot-scale adiabatic stainless steel and beaded-glass steam stripper for removal of ammonia, hydrogen sulfide and carbon dioxide from oil shale process wastewaters is discussed; emphasis is placed on the benefits steam stripping would accord biooxidation. Ultraviolet radiation had no significant effect on the biorefractory organic solutes in retort water. Extensive ozonation structurally altered 14% of the recalcitrant dissolved organic carbon. Ozonation mediated by ultraviolet radiation had a synergistic effect. Potent chemical oxidation was incapable of effecting sufficient structural alteration of the biorefractory compounds to encourage renewed biooxidation. This implies that oxidative enzyme systems may also be incapable of promoting further alteration or mineralization of these recalcitrant solutes. (Geiger-PTT)
W86-01982

TECHNICAL GUIDE ON BIOLOGICAL NUTRIENT REMOVAL: THE PHOREDOX PROCESS,
National Inst. for Water Research, Pretoria (South Africa).
M. J. N. Simpkins, and A. Gerber.
1981. 20 p, 13 fig, 5 tab, 27 ref.

Descriptors: *Wastewater treatment, *Nutrient removal, Phoredox process, Phosphates, Nitrates, Nitrogen, Denitrification, Biological wastewater treatment, Design criteria, Pilot plants, Anaerobic digestion, Aerobic digestion, Clarifiers, Sludge.

This guide, intended as a help in design and operation of the Phoredox process, was developed from data obtained at a Pretoria pilot plant operating on domestic sewage. The Phoredox process is a five-stage process designed to remove nitrogen and phosphorus by biological means. These stages are as follows: anaerobic--denitrification and phosphate release; primary anoxic--additional denitrification of nitrates; primary aeration--oxidation of biodegradable nitrogen and carbonaceous matter; secondary anoxic and aerated--denitrification of nitrates formed in the previous stage; and clarifier--separation of phosphate-containing solids. A pilot plant experience is detailed. Phosphate removal efficiencies were 78% and 68% for settled sewage feed and raw sewage feed, respectively. Effluent nitrate and phosphate concentrations regularly were higher on weekends, coinciding with the drop in COD. Several critical points in design and operation are emphasized. Aeration must be uniform so that no anaerobic zones exist. The anoxic retention time can be increased during periods of low COD. Excess oxygen uptake in the aeration gases or from the atmosphere should be avoided prior to entering the anoxic phases. (Cassar-PTT)
W86-01998

AQUACULTURE SYSTEMS FOR WASTEWATER TREATMENT: SEMINAR PROCEEDINGS AND ENGINEERING ASSESSMENT,
Environmental Protection Agency, Washington, DC. Municipal Construction Div.
Proceedings held September 11-12, 1979, University of California-Davis. Report EPA 430/9-80-006, September 1979, MCD-67. 485 p.

Descriptors: *Wastewater treatment, *Aquaculture, *Aquatic plants, *Fish, Bilogical wastewater treatment, Tertiary wastewater treatment, Lagoons, Wastewater lagoons, Wetlands, Water hyacinth, Nutrient removal.

Papers on wastewater aquaculture are divided into several categories: overview, use of wetlands (creation of new wetlands, use of existing wetlands, and use of cypress domes), aquatic plant systems (mainly water hyacinth), combined systems with aquatic pants and fish or shellfish, and economic and energy aspects. (Cassar-PTT)
W86-02047

ENGINEERING ASSESSMENT OF AQUACULTURE SYSTEMS FOR WASTEWATER TREATMENT: AN OVERVIEW,
Cold Regions Research and Engineering Lab., Hanover, NH.
S. Reed, R. Bastian, and W. Jewell.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 1-12.

Descriptors: *Wastewater treatment, *Aquaculture, Wetlands, Aquatic plants, Fish, Ponds, Stabilization ponds, Water hyacinth, Biological wastewater treatment.

Aquaculture technology was evaluated for its suitability for municipal wastewater treatment. Artificially constructed wetlands show promise of general application. Water hyacinth systems are ready for routine use in municipal wastewater treatment in climates where the plants grow naturally. The possibility of using more cold-tolerant plants should be investigated. In combined systems finfish effectively participate in the treatment process, removing suspended solids in final polishing. Combined systems cannot presently be optimized for both protein/biomass production and wastewater treatment. Although information on operating fish culture units in stabilization ponds is available, routine design for the purpose of wastewater treatment is not yet possible. (Cassar-PTT)
W86-02048

FEDERAL ROLE AND INTEREST BY EPA'S CONSTRUCTION GRANTS PROGRAM IN AQUACULTURE SYSTEMS FOR MUNICIPAL WASTEWATER TREATMENT,
Environmental Protection Agency, Washington, DC.
J. N. Smith, and R. K. Bastian.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 29-33, 6 ref.

Descriptors: *Wastewater treatment, *Aquaculture, Federal jurisdiction, Construction, Grants Program, Innovative/alternative technology.

The subject of water pollution control and wastewater treatment can be seen as a problem of biology rather than simply one of engineering. The scientific basis for treating and the reuse/recycling of wastewater should give greater emphasis to ecology and the management of natural biological systems. Neither the technological problems of designing biological systems nor the political and institutional constraints facing their implementation should prevent the increased future use of aquaculture systems for wastewater treatment. Where these systems can be made to work they should offer effective solutions to the need for cost-effective, environmentally acceptable, and energy efficient wastewater treatment and recycle/reuse practices. In order to assist in encouraging greater use of these aquaculture systems for wastewater treatment, we need to make sure that the results of past and ongoing research efforts are effectively applied to innovative/alternative technology projects funded through the EPA Construction Grants Program. (Author)
W86-02049

USE OF AQUATIC PLANTS AND ANIMALS FOR THE TREATMENT OF WASTEWATER: AN OVERVIEW,
California Univ., Davis. Dept. of Civil Engineering.
G. Tchobanoglous, R. Stowell, R. Ludwig, J. Colt, and A. Knight.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 35-55, 3 fig, 6 tab, 16 ref.

Descriptors: *Wastewater treatment, *Aquaculture, Aquatic plants, Fish, Biological wastewater treatment, Algae, Zooplankton, Shellfish, Crustaceans, Design criteria.

Aquatic systems employing plants and animals have been proposed as alternatives to conventional wastewater treatment systems. The fundamental difference between conventional and aquatic systems is that in the former, wastewater is treated rapidly in highly managed environments, whereas in the latter, treatment occurs at a comparatively slow rate in essentially unmanaged natural environments. The consequences of this difference are (1) conventional systems require more construction and mechanization but less land than aquatic systems, and (2) conventional processes are subject to greater operational control and less environmental influence than aquatic processes. The major stimulus for further research into the fundamentals, design, and management of aquatic systems is the potential for reducing the construction and operation and maintenance costs for wastewater treatment. The general concept involved in the design and use of aquatic systems are presented and the implications are discussed in this overview. (Author)
W86-02050

WETLANDS CREATION FOR HABITAT AND TREATMENT - AT MT. VIEW SANITARY DISTRICT, CA.,
Mountain View Sanitary District, Martinez, CA.
F. C. Demgen.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 61-73, 4 fig, 2 tab, 12 ref.

Descriptors: *Wastewater treatment, *Aquaculture, *Wetlands, Aquatic habitats, Nutrient removal, Nitrogen, Phosphorus, Mt. View, California, Habitats, Aquatic plants, Vegetation, Algae, Animals, Invertebrates.

The Mt. View (California) Sanitary District's wetlands creation project on low lying reclaimed tidal lands, uses treated sewage effluent as a freshwater source. The wetlands system covers 20.3 acres and consists of five interconnected areas with tributary edge habitat. Detention time is 5 days at design capacity. The ecosystem has been balanced and healthy. The habitat supports 72 species of plants, 21 species of animals, 90 species of birds, and 34 species of aquatic invertebrates. Natural predators control mosquito breeding. No avian botulism or odors are evident because good water circulation is maintained. Redwood bark floats have been added to provide supplementary habitat for aquatic invertebrates. Water quality parameters are as follows: (1) dissolved oxygen, 1 mg/liter to supersaturation, normally above 5 mg/liter, (2) BOD, varies seasonally, usually less than loading levels and consists of algae and other organisms, (3) suspended solids, usually reduced in winter but not in summer, (4) nitrates, >90% removal consistently, (5) ammonia and organic nitrogen, about 60% removal, and (6) phosphates, 37-53% removal.

W86-02051

CYPRESS WETLANDS FOR TERTIARY TREATMENT,
Boyle Engineering Corp., Orlando, FL.
W. R. Fritz, and S. C. Helle.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 75-81, 7 fig. ENV76-23276.

Descriptors: *Wastewater treatment, *Wetlands, *Cypress, Florida, Nutrient removal, Biological wastewater treatment, Tertiary wastewater treatment, Swamps.

Cypress domes (shallow, saucer-shaped depressions receiving drainage water) are technically feasible as a tertiary wastewater treatment method. Three concepts are possible. (1) The natural dome needs little modification. Treated wastewater, applied to the center of the dome percolates to the groundwater, losing contaminants on the way. (2) The isolated dome needs an earth dike around the perimeter to keep out storm runoff and retain wastewater. (3) The flow through system operates as a sheet flow through the cypress strand with purification en route to a downstream waterway. Tests show 98% total nitrogen removal and 97% total phosphorus removal. Cypress strands have economic advantages over the other methods because they can process a larger volume than the domes. Bacterial and viral contamination of the groundwater do not appear to be a problem if effluent is sufficiently chlorinated and if all short-circuits to the groundwater are avoided. Areas suitable for municipal treatment must have the following: sufficient capacity, low failure rates, flood and natural disaster resistance, adequate sunshine, electricity for pumps, and a sufficient safety factor. (Cassar-PTT)
W86-02052

DRUMMOND PROJECT - APPLYING LAGOON SEWAGE EFFLUENT TO A BOG: AN OPERATIONAL TRIAL,
Geological Survey, Ithaca, NY.
W. M. Kappel.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Poceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430-/9-80-006, September 1979. MCD-67. p 83-90.

Descriptors: *Wastewater treatment, *Wetlands, *Bogs, Shagnum, Drummond, Wisconsin, Biological wastewater treatment, Lagoons.

The Drummond Project (Wisconsin) is a multiresource continuing study of a sphagnum bog and its response to the application of sewage effluent. The intent of the project is to understand the dynamics of this type of wetland as well as determining whether this type of wetland can be used to effectively treat and assimilate residential sewage effluent. Up to this time, little was known of the dynamics or treatment capabilities of sphaghnum peat wetland. (Author)
W86-02053

EFFECTIVENESS OF A WETLAND IN EASTERN MASSACHUSETTS IN IMPROVEMENT OF MUNICIPAL WASTEWATER,
IEP, Inc., Wayland, MA.
D. A. Yonika.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 91-100, 4 fig, 3 tab.

Descriptors: *Wastewater treatment, *Wetlands, Biological wastewater treatment, Tertiary wastewater treatment, Concord, Massachusetts, Marshes, Nutrient removal, Nitrogen removal, Phosphorus removal.

The Concord, Massachusetts, sewage treatment plant discharges secondary effluent to a 48-acre deep marsh. The wetlands functions as two units: a 6-acre shallow marsh/shrub swamp and the deep marsh. Retention time is 57 days. Final discharge is into the Concord River. Concentrations of substances (in mg/liter) in effluent and in discharge to the river, respectively, were as follows: ammonia N, 8.0 and 0.15; nitrate-N, 3.1 and 0.47; nitrite nitrogen, 0.019 and 0.010; Kjeldahl N, 10.0 and 0.77; total phosphorus, 2.1 and 0.17; orthophosphate, 1.6 and 0.10; and BOD, 38.2 and 2.3. Average annual removal efficiencies ranged from 20% for nitrate-N to 67% for BOD. Nitrite-N was released from the system. Removal efficiency varied seasonally. The BOD uptake was higher on an annual basis in the shallow area (20.8 pounds per acre per day). The shallow area was also more efficient than the deep marsh in removing phosphorus. Ammonia-N removal rates were higher in the deep marsh; nitrate-N removal rates were higher in the shallow area. (Cassar-PTT)
W86-02054

WETLAND TERTIARY TREATMENT AT HOUGHTON LAKE, MICHIGAN,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
R. H. Kadlec.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 101-139, 13 fig, 11 tab, 43 ref.

Descriptors: *Wastewater treatment, *Wetlands, Biological wastewater treatment, Nutrient removal, Nitrogen removal, Phosphorus removal, Tertiary wastewater treatment, Environmental effects, Aquatic habitats, Habitats, Plants, Animals, Houghton, Michigan.

Secondary wastewater effluent was discharged to a 7 sq km peatland near Houghton, Michigan, for five consecutive summers. All nitrogen and phosphorus was stored or removed within a 5-acre area at a discharge rate of 100,000 gal/day and within a 50-acre area at a discharge rate of 1 million gal/day. Chloride and other inactive dissolved ions moved through the wetland with very little change. pH, higher in the discharge, dropped rapidly to background levels (slightly acid) as the discharge traveled across the wetland. Conductivity also dropped to background levels. Suspended solids were deposited close to the discharge area. Erosion, plant mortality, odor, and effects on animals and birds were nonexistent. The only visual effects were greener plants and slightly deeper water near the discharge. Coliforms and viruses appeared at equal levels in the discharge and the wetland. (Cassar-PTT)
W86-02055

ENGINEERING, ENERGY AND EFFECTIVENESS FEATURES OF MICHIGAN WETLAND TERTIARY WASTEWATER TREATMENT SYSTEMS,
Williams and Works, Grand Rapids, MI.
T. C. Williams, and J. C. Sutherland.
IN: Acquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979, MCD-67. p 141-173, 12 fig, 3 tab, 15 ref.

Descriptors: *Wastewater treatment, *Wetlands, Biological wastewater treatment, Irrigation, Wastewater irrigation, Tertiary wastewater treatment, Houghton, Vermontville, Michigan, Phosphorus removal, Nitrogen removal, Spray irrigation, Energy, Capital costs.

Two markedly different Michigan wetlands are receiving pond stabilized secondary treated nonchlorinated wastewater. Both operations result in removal of 98%-100% of phosphorus through contact with reactive soils. At Vermontville, flood irrigation fields (11.5 acres) overgrown with volunteer wetland vegetation (mainly cattail) treat and dispose of wastewater princpally by slow seepage (4 inches-week) through phosphorus-absorbing clayey-silty glacial till. Occasional uncontrolled runoff of wetland surface waters releases phosphorus, BOD, and uspended solids in concentratio slightly above permitted limits. Seepage wetlan offer potential advantages compared to upla spray irrigation for small communities. Savings 25% or greater on capital plus land costs can b expected for flow below 0.1 MGD average flow Field maintenance may not be needed, and irrig tion energy costs need be no higher than those f surface irrigation of uplands. At Houghton Lak natural state-owned wetlands (600 acres) treat an dispose of wastewater by overland flow across reactive peat substrate. Construction and maint nance in 1978 involved negligible ecologic impact. Construction was done in the dorma months between March and June. The wetlan transmission and irrigation pipelines are strappe to a wooden walkway suspended 2.5 ft above th wetland on pole pilings anchored in clay. The co of the wetland wastewater distribution system w $21.00/ft (1979 dollars). Irrigation electric energy costs were approximately $7.21 in 197 The wetland capital and land costs represent sa ings of approximately $1 million compared upland irrigation. (Author)
W86-02056

ENGINEERING DESIGN DATA FOR SMAL VASCULAR AQUATIC PLANT WASTEWATE TREATMENT SYSTEMS,
National Space Technology Labs., NSTL Statio MS.
B. C. Wolverton.
IN: Aquaculture Systems for Wastewater Trea ment: Seminar Proceedings and Engineering A sessment, September 11-12, 1979, University California-Davis. EPA 430/9-80-006, Septemb 1979. MCD-67. p 179-192, 3 fig, 4 tab, 12 re

Descriptors: *Wastewater treatment, *Aquacu ture, *Aquatic plants, Lagoons, Wastewater goons, Water hyacinth, Duckweed, Phenol, Bi logical wastewater treatment, Seconda wastewater.

A general background of the research findings the National Aeronautics and Space Administr tion's Vascular Aquatic Plant Program usi higher plants such as the water hyacinth (Eichho nia crassipes) and duckweed (Lemna sp. and Spir dela sp.) to treat domestic wastewater is presente New data on a small two-cell lagoon system usi only duckweed is included. Further laboratory e periments were conducted to correlate BOD r moval with known wet masses of water hyacinth The data from these experiments with domest wastewater indicates that an average total BO removal rate of 4.0 mg BOD/gram wet weig could be achieved with a seven day retention tim When a phenol solution is substituted for t wastewater, the average total BOD removal is 3 mg BOD/gram wet weight in seven days. Th data along with the results of the previous fie experiments, is used to develop design criteria f small domestic wastewater treatment systems ser icing a maximum of 3000 people. The criteria f these systems addresses the problems of BOD r duction, total suspended solids reduction, od control, and sludge accumulation. (Author)
W86-02057

DEVELOPMENT OF HYACINT WASTEWATER TREATMENT SYSTEMS I TEXAS,
Texas State Dept. of Health, Austin.
R. Dinges.
IN: Aquaculture Systems for Wastewater Trea ment: Seminar Proceedings and Engineering A sessment, September 11-12, 1979, University California-Davis. EPA 430/9-80-006, Septemb 1979. MCD-67. p 193-231, 16 fig, 4 tab, 15 ref, append.

Descriptors: *Wastewater treatment, *Aquacu ture, *Aquatic plants, *Water hyacinth, Biologic wastewater treatment, Nutrient removal, Nitroge removal, Phosphorus removal, Algae, Texas, Hy draulic loading.

Plant-scale wastewater treatment by water hy cinth culture has been implemented in seven Texas locations. Some general conclusions can b

drawn from these experiences. Sufficient design data is presently available for constructing hyacinth tretment facilities in warm climates. However, optimal design is necessary to minimize areas and costs for using this treatment system in greenhouses in temperate climates. The most critical consideration in culture basin design is hydraulic loading. A triangle-shaped basin is an ideal shape; two of these may be combined to form a rectangle for better land use. The primary pollutant removal mechanism in hyacinth treatment is removal of suspended particulates. Since hyacinth harvesting disrupts treatment, multiple culture basins should be used for alternate operation. Nitrogen management is a key factor in utilizing hyacinths for wastewater treatment or for biomass production. Stablilization ponds can be designed for effective nitrogen reduction. Hyacinth removes most remaining nitrogen in pond effluent, especially that in organic form such as algae. Effluent from a hyacinth treatment system can produce effluents with less than 10 mg/liter BOD and total suspended solids. (Cassar-PTT)
W86-02058

WATER HYACINTH ADVANCED WASTEWATER TREATMENT SYSTEM,
Coral Ridge Properties, FL.
J. Swett.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. p 233-255, 2 fig, 7 tab.

Descriptors: *Wastewater treatment, *Aquaculture, *Aquatic plants, *Water hyacinth, Advanced wastewater treatment, Lagoons, Coral Springs, Florida, Biological wastewater treatment.

A one-year field experiment at the 378,530 liters/day (100,000 gpd) level has demonstrated that a system of 5035 sq m (54,200 sq ft) of water hyacinth (Eichhornia crassipes) lagoons can provide advanced treatment to effluent from an activated sludge plant by achieving removal rates of 67% for total suspended solids, 98% for biochemical oxygen demand, 97% for total nitrogen and 79% for total phosphorus. Biomass produced by the system offers a potential for energy, fertilizer or feeder production. (Author)
W86-02059

WATER HYACINTH WASTEWATER TREATMENT SYSTEM AT WALT DISNEY WORLD,
Reedy Creek Utilities Co., Inc., Lake Buena Vista, FL.
P. Kruzic.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis, EPA 430/9-80-006, September 1979. MCD-67, p 257-271, 2 fig, 3 tab, 5 ref.

Descriptors: *Wastewater treatment, *Aquatic plants, Water hyacinth, Biological wastewater treatment, Walt Disney World, Florida.

A water hyacinth wastewater treatment system is being tested at Walt Disney World, Florida. Consisting of three 1/4-acre channels with piping, hydraulic control devices, and pumping equipment, it is designed to handle flows up to 200,000 gpd with a probable minimum of 50,000 gpd. The complete-mix mobile harvesting system includes a front end loader, conveyor-chopper, and forage wagon. Although most components of the project are operating as planned, some problems have developed. For example, in using a backhoe to seed the hyacinths into the channels, much grass and dollar-weed was also brought in. The unwanted plant species had to be removed. In treating primary effluent, dissolved oxygen concentrations are very low. Floating sludge and fly larvae exist in ponds which once supported a mosquitofish population. Monitoring of the system continues. (Cassar-PTT)
W86-02060

UTILIZATION OF WATER HYACINTHS FOR CONTROL OF NUTRIENTS IN DOMESTIC WASTEWATER -- LAKELAND, FLORIDA,
Dawkins and Associates, Inc., Orlando, FL.
E. A. Stewart.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 273-293, 8 fig, 1 tab, 8 ref.

Descriptors: *Wastewater treatment, *Aquaculture, *Aquatic plants, Fish, Water hyacinth, Lakeland, Florida, Nutrient removal, Nitrogen removal, Phosphorus removal, Invertebrates, Mosquitoes, Biological wastewater treatment, Lagoons, Wastewater lagoons, Ponds.

A large (up to 13 mgd) water hyacinth treatment demonstration project in Lakeland, Florida, was based on nutrient removal requirements of 1.5 mg/liter total N and 0.4 mg/liter total P. The system consisted of three one-acre lagoons in series. Plant health and chlorophyll content declined from Pond 1 to Pond 3, with iron the limiting nutrient. Oxygen levels in the water were adequate to above saturated, rarely falling below 2 mg/liter in Pond 1, which was expected to have the lowest levels. pH changed from neutral to slightly alkaline. BOD and suspended solids were reduced somewhat. Nitrogen and phosphorus uptake were greater than expected for the crop density of 99 metric tons/ha. Water color and turbidity were noticeably reduced throughout the system. Dissolved solids decreased due to selective uptake of certain ions such as ferrous ion, calcium, and chloride. Coliform reduction was dramatic. The biological nature changed throughout the system. In Pond 1 hyacinths were large; macroinvertebrates were restricted to chironomid larvae, mosquito larvae, and a snail; two fish species were surviving well. In Pond 2 the hyacinths were smaller and suffered from chlorosis; the invertebrate and fish populations were diverse and numerous. In Pond 3 hyacinths were very chloratic; fish and invertebrates were even more diverse than in Pond 2. Designing the system for plant growth kinetics in cool weather allows for a safety margin. (Cassar-PTT)
W86-02061

SOME ECOLOGICAL LIMITS TO THE USE OF ALTERNATIVE SYSTEMS FOR WASTEWATER MANAGEMENT,
Michigan State Univ., East Lansing. Inst. of Water Research.
D. L. King.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 299-307, 14 ref.

Descriptors: *Wastewater treatment, *Aquaculture, *Lagoons, Ponds, Biological wastewater treatment, Algae, Cyanophyta, Fish, Nitrogen removal, Phosphorus removal, Standards, Effluent standards, Ecosystems.

Biological, chemical, and physical factors interact to place limitations on the use of natural ecosystems for wastewater treatment. An understanding of these limits allows better design of treatment systems to fit individual environmental and wastewater conditions. At the Michigan State University Water Quality Management Facility expansion of the lagoon system was based on effluent tests which showed excellent BOD and coliform removal. However, BOD was underestimated by the 5-day test. Algae, spilling into the effluent, did not decompose within 5 days but became part of the BOD load further downstream. When suspended solid limits were placed on lagoon effluents, lagoon systems required revision to meet standards. Other natural factors to consider are seasonal variations and the lack of a natural mechanism to remove phosphorus on a long-term basis. The nutrient balance in wastewater is not suitable for pond biota, favoring growth of undesirable blue-green algae. The presence of fish which eat zooplankton also favors eventual dominance of blue-green algae and supression of macrophytes. Another limiting factor, toxic to fish, is the ammonia and high pH common in wastewater ponds. The strict water quality standards with respect to pathogens and other contaminants discourages use of wastewater aquaculture food products at this time. (Cassar-PTT)
W86-02062

UTILIZATION OF SILVER AND BIGHEAD CARP FOR WATER IMPROVEMENT,
Arkansas Game and Fish Commission, Lonoke.
S. Henderson.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979, MCD-67. p 309-350, 5 append.

Descriptors: *Wastewater treatment, *Aquaculture, *Fish, Benton, Arkansas, Water quality, Silver carp, Bighead carp, Carp, Lagoons, Wastewater lagoons, Biological wastewater treatment.

Filter feeding fish, the silver and bighead carp, were stocked in an existing lagoon treatment system in 1975-76 for a preliminary evaluation of the effect of the fish on water quality and the potential of this nutrient source for fish production. In a full-scale 6-cell, 24-acre facility at Benton, Arkansas, BOD removal was 96.4% and suspended solids removal was 86% during the first 8 months of the study. Detailed water quality monitoring results are given in the appendixes. With three months remaining in the growing season, the standing crop of fish in the four ponds containing fish was >22,777 kg, a total average production of 3344 kg/ha. Fish tissue and water samples were regularly analyzed for particular pathogens, metals, and pesticides. Only Staphylococcus bacteria, copper and mercury levels were above detection limits. Using the fish as fish meal would yield a gross return of $430-$575/ha/year; for direct human consumption, $3600-$4525/ha. (Cassar-PTT)
W86-02063

TREATED SEWAGE EFFLUENT AS A NUTRIENT SOURCE FOR MARINE POLYCULTURE,
Woods Hole Oceanographic Institution, MA.
J. H. Ryther.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979, MCD-67. p 351-375, 7 fig, 5 tab, 5 ref.

Descriptors: *Wastewater treatment, *Aquaculture, Fish, Shellfish, Oysters, Clams, Flounder, Lobsters, Biological wastewater treatment, Tertiary wastewater treatment, Seaweed, Algae, Nitrogren removal, Nutrients.

A biological tertiary sewage treatment-marine aquaculture system was developed and studied at the Woods Hole Oceanographic Institution. Secondary sewage effluent mixed with sea water was used to grow phytoplankton in continuous flow-through cultures. This product was fed to several varieties of shellfish in stacked trays. Uneaten food and wastes from the shellfish supported small invertebrates, in turn eaten by lobster and flounder stocked in the shellfish areas. Effluent from the shellfish tanks was passed through red algae grown in suspended culture to reduce nutrients further. Total nitrogen removal efficiency was 93.6%. (Cassar-PTT)
W86-02064

SOLAR AQUACELL SYSTEM FOR PRIMARY, SECONDARY OR ADVANCED TREATMENT OF WASTEWATERS,
Solar AquaSystems, Inc., Encinitas, CA.
W. C. Stewart, and S. A. Serfling.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1969. MCD-67. p 377-412, 6 fig, 3 tab, 44 ref.

Descriptors: *Wastewater treatment, *Solar energy, Solar AquaCell system, Biological wastewater treatment, Nutrient removal, Aquatic plants, Hercules, California, Lagoons, Wastewater

lagoons, Advanced wastewater treatment, Tertiary wastewater treatment, BioWeb substrates, Aeration, Anaerobic conditions, Primary wastewater treatment.

The Solar AquaCell process consists of a series of multicell lagoons, a diffused aeration system, high surface area fixed-film substrates as a biofilm habitat, aquatic macrophytes, greenhouse pond cover, and a solar heat exchange system to heat the water phase. Three AquaCell pond systems (anaerobic, facultative, and aerobic) each with high surface area biofilm devices, can be used in series to achieve primary, secondary and/or advanced treatment, respectively. The system designed for the city of Hercules, California, 1325 cu m per day of raw wastewater, is described. (Cassar-PTT)
W86-02065

RESOURCE RECOVERY FROM WASTEWATER AQUACULTURE,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
L. O. Bagnall.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979, MCD-67. p 421-439, 11 fig.

Descriptors: *Wastewater treatment, *Aquaculture, *Aquatic plants, Biological wastewater treatment.

Removal and recycling of the nutrients and other components in the wastewater aquaculture system are completed by harvesting, processing and utilizing the aquatic organisms in which the nutrients are collected. Aquatic species grown in wastewater have been experimentally used for food, feed, fiber, fertilizer, and energy. Some of the processes and products appear to be technologically and economically feasible on an operational scale. (Author)
W86-02066

ENERGY FROM WASTEWATER AQUACULTURE SYSTEMS,
Ecoenergetics, Inc., Vacaville, CA.
J. R. Benemann.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 441-458, 4 tab, 39 ref.

Descriptors: *Wastewater treatment, *Aquaculture, *Anaerobic digestion, *Aquatic plants, Energy, Biological wastewater treatment, Digestion, Methane, Biomass, Ponds.

Aquatic biomass produced in wastewater treatment ponds can be an energy source. The high moisture, high nutrient, and low lignocellulose content of most aquatic plants makes them ideal substrates for anaerobic digestion. Although little specific data is available, this reaction can be expected to proceed without significant difficulties and at rates comparable to those seen with sewage sludge. Studies are being conducted on two-phase reactors which separate the acid and methane bacterial cultures. Other technologies are gas recovery from landfills or anaerobic ponds and the anaerobic filter process using an expanded bed reactor. The possible fuel outputs for a secondary wastewater aquaculture system of 15 mgd are 6.0 MBTU/MG with energy conservation of 6.0 MBTU/MG. A tertiary treatment system would produce about 37.5 MBTU/MG of net fuel output and have an energy conservation potential of 13.5 MBTU/MG. (Cassar-PTT)
W86-02067

OVERVIEW OF THE LEGAL, POLITICAL, AND SOCIAL IMPLICATIONS OF WASTEWATER TREATMENT THROUGH AQUACULTURE,
Denver Research Inst., CO.
L. C. Lohman.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 459-474, 13 ref.

Descriptors: *Wastewater treatment, *Water law, *Aquaculture, *Political aspects, *Social aspects, Legal aspects, Public participation, California, Regulations, Federal jurisdiction, State jurisdiction, Legislation, Standards, Water rights, Water reuse, Attitudes.

The legal, political, and social elements involved in full-scale aquaculture for wastewater treatment are highlighted. Emphasis is on California, where several aquaculture projects are under development. On the Federal level many statutes, regulations, and agencies are concerned with wastewater aquaculture. The National Water Pollution Control Act and its amendments exert the most direct control over wastewater discharges. State law regarding water quality is largely derived from Federal law. The power of particular interest to proponents of wastewater aquaculture is the state control over rights to use water and obligations to protect all water users. Wastewater aquaculture can change the quantity and quality of water for downstream users. States generally exercise control over all aspects of wastewater treatment with special concern about effects on public health. Legal and political elements are closely entwined. Influences and policies affect decisions on new wastewater facilities. Many conflicts are possible. Society reacts to proposed projects as different interest groups, from individuals to large organizations. Acceptance of wastewater aquaculture by the public is easier if effluent meets standards and no nuisances are created. (Cassar-PTT)
W86-02068

ECONOMICS OF AQUATIC TREATMENT SYSTEMS,
Metcalf and Eddy, Inc., Sacramento, CA.
R. W. Crites.
IN: Aquaculture Systems for Wastewater Treatment: Seminar Proceedings and Engineering Assessment, September 11-12, 1979, University of California-Davis. EPA 430/9-80-006, September 1979. MCD-67. p 475-485, 11 tab, 20 ref.

Descriptors: *Wastewater treatment, *Aquaculture, *Aquatic plants, *Fish, Biological wastewater treatment, Tertiary wastewater treatment, Lagoons, Wastewater lagoons, Wetlands, Water hyacinth, Nutrient removal, Advanced wastewater treatment, Oxidation ponds, Economic aspects, Wetlands, Energy, Land disposal.

Aquatic treatment systems, although still in the development stage in most areas, offer low-cost, low-energy solutions for wastewater treatment. For advanced secondary treatment (BOD and suspended solids, 10 mg/liter; no nutrient removal), combinations of oxidation ponds with water hyacinths or wetlands are cost effective compared at 1 mgd with land treatment or conventional treatment. For the lowest cost flowsheet examined, the land cost can reach $115,000/acre before the conventional activated sludge system becomes economically competitive. For advanced wastewater treatment (nitrogen, 3 mg/liter; phosphorus, 1 mg/liter), aquatic systems alone have not been developed technically to achieve the same standards. The aquatic processes can, however, be integrated with land treatment and oxidation ponds to achieve this high quality of effluent. In the cases studied, the combined equatic-land treatment systems were less expensive than land or conventional treatment at 1 and 10 mgd. As aquatic systems become further developed and demonstrated, the costs will become more firmly established. In addition, the economic benefits (such as from compost, fertilizer, soil conditioners, or biogas) may offset some of the costs of wastewater treatment in the future. (Author)
W86-02069

TOXIC AND HAZARDOUS WASTES,
Proceedings of the Sixteenth Mid-Atlantic Industrial Waste Conference, June 24-26, 1984. Technomic Publishing Co., Inc., Lancaster, PA. 1984. Edited by Michael D. LaGrega and David Long. 587 p.

Descriptors: *Hazardous materials, *Indust wastes, *Groundwater pollution, *Waste-w treatment, *Waste disposal, Sludge disposal, C ferences, Groundwater management, Land disp al, Activated sludge, Heavy metals, Incinerat Recycling, Industrial wastewater, Landfills, S posium.

This book is an outgrowth of the proceeding the sixteenth Mid-Atlantic Industrial Waste C ference. The conferences are designed to provi forum for interchange of new technical and n technical solutions for industrial pollution con problems of the region by allowing regulat agencies, industrial agencies, universities, and c sulting engineers to exchange information reg ing their various activities. The sessions of conference included: biological wastewater tr ment, waste incineration and energy recov international research topics, regulatory com ance, recycle/reuse, heavy metal control, physi chemical processes, sludge management, hazard waste-site clean-up, and groundwater protecti This book is intended to provide a state-of-the synopsis of contemporary practice in the contro industrial, toxic, and hazardous wastes. (Geig PTT)
W86-02094

BIODETOXIFICATION OF HAZARDO WASTEWATERS WITH ACTIVATED ROT ING BIOLOGICAL CONTACTORS,
Memphis State Univ., TN. Dept. of Civil En neering.
J. W. Smith, and L. W. Moore.
IN: Toxic and Hazardous Wastes, Technomic P lishing Co., Lancaster, PA. 1984. p 15-28, 13 fi tab, 2 ref.

Descriptors: *Hazardous materials, *Orga wastes, *Biological wastewater treatm *Wastewater treatment, *Organic pesticid Chlorinated hydrocarbons, Halogenated pesticid Copper, Leachates, Industrial wastewater, Ind trial wastes, Activated sludge process, Aerati Pesticides, Color, Hydrogen ion concentration.

A bench-scale rotating biological contactor (R that was modified to include an aeration basin final clarifier with sludge recycle to the fixed f media (ARBC) was tested on several hazard organic wastes. The ARBC system was compa to a completely mixed activated sludge syst with respect to treatability of pesticide formulat wastewater, and wastewaters containing dog fo or Cu and synthetic leachates containing hep chlor, chlordane and endrin, or orga wastewaters high in color or pH. Results show that ARBC systems achieved higher organic moval efficiencies than did activated sludge s tems, and generally removed greater quantities hazardous pollutants such as Cu and pesticid About 95% of the heptachlor, chlordane endrin were removed from wastewater by t ARBC systems operating in series. The AR system tolerated as high as 5 milligrams/liter so ble Cu, but long term exposure to such concent tions would probably interfere with treatment e ciency. The ARBC system exhibited greater moval efficiencies in the treatment of a stro organic industrial waste than did a complet mixed activated sludge system. (Geiger-PTT)
W86-02095

APPLICATION OF THE TOTAL BARRIER C IDATION DITCH ACTIVATED SLUD PROCESS FOR SINGLE STAGE NITRIFIC TION-DENITRIFICATION OF HI STRENGTH WASTEWATER,
Reid Engineering Co., Fredericksburg, VA.
J. H. Reid.
IN: Toxic and Hazardous Wastes, Technomic Pu lishing Co., Lancaster, PA. 1984. p 29-41, 2 fig tab.

Descriptors: *Denitrification, *Nitrification, *Ac vated sludge process, *Wastewater treatme *Food-processing wastes, Aeration, Aerators, A

monia, Food processing industry, Industrial wastes, Biological wastewater treatment, Suspended solids, Biological oxygen demand, Activated sludge, Oxidation.

In January 1981, the first Total Barrier Oxidation Ditch activated sludge system in the U.S. began operation at a poultry processing plant to provide nitrification for ammonia removal, denitrification for nitrate removal, and enhance secondary BOD and suspended solids treatment. The barrier oxidation ditch basin is preceded by an anaerobic flow equalization pretreatment basin. The oxidation ditch operates at an average volume of 700,000 gal. Three activated sludge clarifiers are operated in parallel with a total effective settling area of 1350 sq ft. One chlorine contact basin is used for combined effluent disinfection and post aeration. The single stage, low load, continuous loop reactor extended aeration activated sludge process was selected for this treatment system upgrade, based on design loadings and performance capability. Performance data shows that the Total Barrier Oxidation Ditch can be utilized as a single activated sludge treatment process, to provide very high removals of carbonaceous and nitrogenous oxygen demand and total N during the warm season months between April and October. During these months nitrification efficiency was 99%, and total N removal efficiency was 92%. During the winter season months, nitrification efficiency was reduced to 97% and total N removal efficiency was reduced to 84%. The automation of aerator oxygen transfer rate to maintain a looped reactor intake the dissolved oxygen concentration less than or equal to .2 milligrams/liter would stabilize denitrification efficiency in the warm season months and greatly improve the denitrification efficiency attainable during the winter season. (Geiger-PTT)
W86-02096

EVELOPMENT OF ENERGY EFFICIENT ACVATED SLUDGE SYSTEMS THROUGH UTIZATION OF NUTRIENT REMOVAL PROCSES,
rginia Polytechnic Inst. and State Univ., Blacksrg. Dept. of Civil Engineering.
W. Randall.
: Toxic and Hazardous Wastes, Technomic Pubning Co., Lancaster, PA. 1984. p 52-63, 2 fig, 4 , 8 ref.

scriptors: *Nutrient removal, *Denitrification, ological wastewater treatment, *Wastewater atment, *Cost analysis, Nutrients, Phosphorus noval, Oxidation, Activated sludge process, ergy, Aeration, Oxidation, Chemical oxygen nand.

logical nutrient removal wastewater treatment cesses have been adequately demonstrated er full-scale conditions to warrant general apation. Due to their decreased oxygen requirents, these processes have the potential to subtially reduce the amount of energy that must expended to treat a given wastewater. The rgy saving aspects of denitrification have been roughly demonstrated by widespread applica. The potential energy savings of biological P oval systems have far less documentation. Rech using biological P removal has shown mise for high COD reduction, when truly anbic conditions prior to highly aerobic condis are maintained. The oxidation ditch modifica of the activated sludge process appears to be lly suited for economic, energy efficient biocal nutrient removal operation. Nutrient reval oxidation ditch design can be readily eved using widely accepted techniques, such lonod type equations. (Geiger-PTT)
-02097

CROBIOLOGY OF FILAMENTOUS BULK OF INDUSTRIAL AND DOMESTIC ACTIED SLUDGE,
nsylvania State Univ., University Park. Dept. ivil Engineering.
I. Williams, R. F. Unz, and K. Beard.
Toxic and Hazardous Wastes, Technomic Pubng Co., Lancaster, PA. 1984. p 64-77, 1 fig, 4 12 ref. CME-79189191.

Descriptors: *Activated sludge, *Microbiological studies, *Bacteria, *Biological wastewater treatment, *Culturing techniques, Wastewater treatment, Activated sludge process, Mixed liquor solids, Microorganisms, Separation techniques, Industrial wastewater, Municipal wastewater.

The distribution of filamentous microorganisms in bulking activated sludge obtained from several industrial and domestic wastewater treatment plants was investigated along with isolation procedures suitable for the recovery of filamentous microorganisms. Microscopic examination of mixed liquor specimens from treatment plants experiencing poorly settling solids, revealed the presence of one or more types of filamentous microorganisms. In general, treatment plants operated at low to medium organic loading rates produced activated sludge solids populated by Haliscomenobacter hydrossis, and Eikelboom types 0041, 0675, and 0803. Aeration basins with higher organic loading rates produced activated sludge solids populated by Sphaerotilus natans, Thiothrix spp., and types 1701 and 021 N. Pretreatment of samples from industrial and domestic sources prior to innoculation of culture media facilitated isolation of filamentous bacteria. A total of 42 axenic strains of bacteria, representing seven distinct groups of filamentous organisms, were isolated. The morphological and cytological features of the isolated bacteria are discussed. (Geiger-PTT)
W86-02098

UTILIZATION OF AN INDUSTRIAL WASTE OIL AS AN ALTERNATIVE FUEL FOR A MUNICIPAL SLUDGE INCINERATOR,
Tennessee Univ., Knoxville.
D. W. Weeter.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 99-107, 2 fig, 2 tab, 4 ref.

Descriptors: *Sludge disposal, *Oil recovery, *Oil wastes, *Recycling, *Sludge utilization, Wastewater treatment, Incineration, Wastewater reclamation, Cost analysis, Municipal wastewater, Waste recovery, Waste disposal, Industrial wastes.

A project to provide fuel beneficiation for a municipal sludge multiple hearth furnace incinerator at the Maryville Regional Wastewater Treatment Plant (MRWTP) is described. Waste oil sludge from the Aluminum Company of America (ALCOA) Tennessee operations was treated with alum and sulfuric acid to reclaim rolling oils. The MRWTP was modified to utilize the reclaimed oil. Fuel switching between natural gas and oil sludge was adopted along with plans to keep the incinerator temperature up when not burning sewage sludge. The new system had no major effects on water quality. The additional ash that was added by the oil was not hazardous and could be legally spread on nearby corn fields. A 50 inch induced draft fan was installed to meet New Source Performance Standards for air quality. The above ground oil storage vessel was diked to comply with EPA oil spill prevention regulations. Since the project was implemented, natural gas costs have decreased from $144 thousand to $1,000 per year. A waste exchange contract was developed between ALCOA and MRWTP.
W86-02099

BIOLOGICAL TREATMENT OF INDUSTRIAL WASTEWATERS IN THE USSR,
American Standards Testing Bureau, Inc., New York.
L. Shmidt.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 121-139, 4 fig, 4 tab, 4 ref.

Descriptors: *Biological wastewater treatment, *Industrial wastewater, *Sludge disposal, *Activated sludge process, *Wastewater treatment, Industrial wastes, Aeration, Chemical treatment, Sludge drying, Sludge disposal, Solid waste disposal, Pulp wastes, Waste disposal, Activated sludge.

Biological treatment is widely used for industrial wastewater treatment in the chemical, petrochemical, and pulp and paper industries in the USSR. The most widely used biological treatment process is the activated biological sludge process and its modifications. The classical plug-flow-recycle system or its modifications such as tapered or step aeration systems are most often used. The standard unit for the biological wastewater treatment facility includes an equalizer, a primary clarifier, an aeration tank and a secondary clarifier. Multi-stage systems for biological wastewater treatment have been designed over the last few years. Five categories of multi-stage systems are identified. To reduce the cost of industrial wastewater treatment, an increase in the loading of aeration tanks and biofilters is needed. The Baikal Pulp Mill wastewater treatment plant includes a biological wastewater treatment system, a chemical wastewater treatment system, lagoons for polishing and aerating wastewaters and sludge thickening, filtering, drying and combustion units. (Geiger-PTT)
W86-02100

FACILITY UPGRADES DUE TO HAZARDOUS MATERIALS REGULATIONS,
GTE Government Systems Corp., Mountain View, CA. Sylvania Systems Group-Western Div.
S. M. Hochstadt.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 158-172, 3 fig, 2 tab, 10 ref.

Descriptors: *Wastewater treatment, *Cost analysis, *Hazardous materials, *Waste storage, *Wastewater facilities, Maintenance costs, Operating costs, Waste disposal, Metal-finishing wastes, Wastewater management, Industrial wastes, Industrial wastewater.

Industry faces a multitude of government regulations dealing with the storage, use, and disposal of hazardous materials in order to protect the health and safety of employees, the public, and the environment. Environmental regulations are handled under the federally legislated Clean Water, Clean Air, and Resources Conservation and Recovery Acts. The discharge of industrial process wastewaters is usually regulated by a local water district or municipal public works department. Most recently, attempts have been made to regulate the storage of hazardous materials in underground tanks. GTE Government Systems Corporation uses four separate chemical and two waste storage facilities which are being upgraded after twenty years of operation. The waste treatment system of the plating shop will feature a package treatment system for cyanide destruction, Cr reduction, pH neutralization, flocculation, clarification, sludge thickening, water recycle and sodium hydroxide. Four waste storage and four reagent storage tanks will be included. A trend of decreasing capital expenses with sharp increases in operating and maintenance initially (but leveling off after 1984) is depicted with $<10\%$ annual increase for upgrading costs. (Geiger-PTT)
W86-02101

INDUSTRIAL WASTEWATER TREATABILITY STUDY ACHIEVING BCT/BAT TREATMENT,
Koppers Co., Inc., Pittsburgh, PA.
A. C. Middleton, J. R. Smith, M. R. Urbassik, R. E. Keffer, and P. W. Sawchuck.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 173-185, 3 fig, 4 tab, 5 ref.

Descriptors: *Organic compounds, *Chemical coagulation, *Bioassay, *Wastewater treatment, *Activated sludge process, Organic wastes, Flocculation, Suspended solids, Toxicity, Pilot plants, Separation techniques, Chemical treatment, Biological wastewater treatment.

The Federal EPA in March 1983 issued proposed effluent guidelines for the organic chemicals, plastics and synthetic fibers industry. The guidelines require conventional pollutant parameters to be regulated by best conventional technology (BCT) and the 129 priority pollutants by best available technology (BAT). To determine the degree of treatment required to meet these limits, Koppers

Company, Inc. conducted a complete on-site wastewater treatability study at its Oil City, Pennsylvania plant. A pilot plant study simulated wastewater pretreatment for oil/water separation, activated sludge treatment, and toxicity testing of the treated effluent. Results showed that pretreatment of wastewater by FEC13 coagulation/flocculation/settling was very effective for removal of suspended matter and emulsified organic material. GC/MS analysis for organic priority pollutants in one effluent sample showed below detectable limit concentrations for all priority pollutant parameters except phenol and 2,6-dinitroluene. Results from both static and continuous flow-through fish bioassays showed the final treated effluent to be nontoxic. (Geiger-PTT)
W86-02102

RATIONAL PROCEDURE FOR ESTABLISHING DISCHARGE CONCENTRATION LIMITS IN MUNICIPAL SEWER USE ORDINANCES,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
J. K. Farmer, S. J. Spiegel, and S. R. Garver.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 186-199, 10 tab, 10 ref.

Descriptors: *Wastewater treatment, *Effluent limitations, *Water quality standards, *Sludge disposal, *Industrial wastewater, Monitoring, Landfills, Wastewater facilities, Waste disposal, Municipal wastewater, Biological wastewater treatment, Water pollution sources, Sewer systems.

The General Pretreatment Regulations require that municipalities throughout the United States develop programs to monitor and control industrial wastewater discharges to their municipal sewer systems. Discharges to publically owned treatment works (POTW) are comprised of controllable and uncontrollable sources. The allocatable loading to the POTW for any particular substance would be derived by subtracting the uncontrollable source contribution from the total allowable POTW loading. The performance criteria to be considered in developing discharge standards includes influent and effluent effects, biological and sludge treatment, and sludge disposal. Limiting concentrations identified at specific points in the treatment system need to be translated back to the treatment plant influent. Since POTW sludges are subject to RCRA regulations if disposal is by landfilling, mathematical equations exist for calculating the maximum concentration of treatment plant influent which will prevent the sludge from being classified as hazardous. The controllable loading for each substance must then be translated to maximum industrial discharge limitations. (Geiger-PTT)
W86-02103

ELECTROLYTIC RECOVERY OF ZINC FROM METAL FINISHING RINSE WATERS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. W. Walters, and D. M. Vitagliano.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 251-264, 5 fig, 3 tab, 10 ref.

Descriptors: *Metal-finishing wastes, *Zinc, *Industrial wastes, *Waste recovery, *Electroplating, Heavy metals, Electrodes, Electrochemistry, Recycling, Wastewater treatment, Corrosion, Metals, Industrial wastewaters.

In an effort to meet Zn discharge limits at an electroplating firm, a review of the literature regarding electrolytic recovery of metals from dilute wastewater, an effluent characterization study to identify sources of Zn within the plant, and a preliminary bench-scale evaluation of the feasibility of electrolytic recovery of Zn, were undertaken. Results showed that the Zn automatic line accounted for 88% of the Zn discharged. An optimum strategy requiring less frequent dumping of rinse tanks would be to stagger tank dumps so that a plant discharge of 4 milligrams/liter (the discharge limit for Zn) would not be exceeded. A bench-scale, electrolytic recovery reactor was constructed and tested to study the technical feasibility of Zn removal from the plating bath rinse stream using this technique. Results showed that the reactor configuration was effective at removing Zn from the complexed, Zn cyanide wastewater. Agitation was important for achieving high rates of Zn deposition. Although corrosion had no noticeable effect on Zn removal rates, it could be a limiting factor economically for this type of wastewater. Use of lower NaCl doses resulted in comparable Zn removal with less electrode corrosion. (Geiger-PTT)
W86-02104

SOLUBLE-SULFIDE PRECIPITATION TREATMENT OF METAL FINISHING WASTEWATER,
Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD.
J. J. Resta, M. Daly, and M. Pressman.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 265-278, 5 fig, 4 tab, 10 ref.

Descriptors: *Chemical precipitation, *Sludge thickening, *Sulfides, *Industrial wastes, *Metal-finishing wastes, Chromium, Metals, Sludge drying, Cost analysis, Sludge disposal, Performance evaluation, Wastewater treatment, Industrial wastewater, Hazardous materials, Electroplating, Metals, Heavy metals.

The performance and operation of the soluble-sulfide precipitation treatment system (SSP) for the removal of metal from finishing wastewater was evaluated at the U.S. Army Belvoir Research and Development Center in Virginia. The SSP system can reduce hexavalent Cr under neutral conditions. A sodium metabisulfite reduction system was included to minimize the amount of sodium sulfide required. Several safety features were included to reduce generation of toxic hydrogen sulfide gas. Total effluent metal concentrations in the SSP system averaged 1 milligram/liter. Sludge generation averaged 0.3 gallons of sludge/1000 gallons of wastewater treated. The sludge thickening and dewatering process performed adequately without the use of sludge conditioners. Chemical costs averaged $0.30/1000 gallons treated waste. The reactivity of the SSP system sludge could not be determined because the EPA has not promulgated a method for evaluating sulfide sludges. If the SSP sludge is determined to be a reactive hazardous waste, sludge disposal costs could limit the use of SSP treatment technology. (Geiger-PTT)
W86-02105

CO-PRECIPITATION OF HEAVY METALS WITH SOLUBLE SULFIDES USING STATISTICS FOR PROCESS CONTROL,
Talbot (Richard S.) and Associates, Inc., Media, PA.
R. S. Talbot.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 279-288, 8 tab, 3 ref.

Descriptors: *Industrial wastewater, *Heavy metals, *Chemical precipitation, *Wastewater treatment, *Metal-finishing wastes, *Heavy metals, Chemical treatment, Sulfides, Industrial wastes, Flocculation, Metals, Electroplating, Statistical methods.

The Talbot Process of sulfide co-precipitation was developed to help electroplating industries meet discharge pretreatment standards. The patented Talbot Process, owned by Richard S. Talbot and Associates, Inc., is used for the removal of metals that are difficult to precipitate as a metal hydroxide. The process can be used in both batch and continuous flow treatment operations, and is easily controlled through the use of statistics. The Talbot Process of sulfide co-precipitation produces a lower dissolved heavy metal content for the metals to be precipitated than conventional hydroxide precipitation alone. Sulfide co-precipitation produces a higher solids settling rate, and enhanced flocculation with anionic, organic polymers. A smaller quantity of sludge is produced as compared with conventional hydroxide precipitation leading to lower sludge disposal costs. The Talbot Process can easily be added to existing conventional systems to protect against future, more stri
heavy metals discharge standards. (Geiger-
W86-02106

**EFFECT OF CHELATING AGENTS ON
REMOVAL OF HEAVY METALS BY SUL
PRECIPITATION,**
Purdue Univ., Lafayette, IN. Dept. of Civil
neering.
R. W. Peters, and D. Bhattacharyya.
IN: Toxic and Hazardous Wastes, Technomic
lishing Co., Lancaster, PA. 1984. p 289-317, 1
10 tab, 16 ref. CR-807760.

Descriptors: *Chemical precipitation, *Sul
*Heavy metals, *Chelating agents, Metal com
es, Chemical treatment, Chemical coagul
Metals, Wastewater treatment, Copper, Zinc,
mium, Flocculation, Hydrogen ion concentr
Chelation.

The precipitation of metal sulfides was st
under both batch and MSMPR precipitation c
tions for various metals, pH conditions,
EDTA concentrations. EDTA forms very s
metal chelates which interfere with the prec
tion of ZnS. Weak chelating agents form
metal chelates; formation of metal sulfide pr
tates predominates. Removal of Cu is nearly
plete even in the presence of EDTA. Th
system shows that a phase transformation fro
initial amorphous kinetically favored precipit
a more crystalline form occurs. The Cu-Zn
Cd, and Cd-Zn systems behave like a single
After CuS precipitation is nearly complete
ZnS reaction becomes significant. For more
plex multi-metal systems, removal of Cu is
complete, the ZnS reaction becomes signif
For more complex multi-metal systems, remo
Cu is nearly complete, while removal of Zn a
were poor. For the continuous precipitatio
ZnS, particle size distributions were poor
though removal of Zn is hindered by E
increased growth rates and larger dominant
cle sizes are observed with increasing EDTA
centrations. The observed larger particle
were attributed to flocculation and formatio
metal hydroxide precipitates. (Geiger-PTT)
W86-02107

**REMOVAL OF HEAVY METALS IN P
USING ALUM OR SODIUM ALUMINATE
PHOSPHORUS REMOVAL,**
Rensselaer Polytechnic Inst., Troy, NY.
D. B. Aulenbach, N. L. Clesceri, M. A. Meye
Vasudevan, and E. Beckwith.
IN: Toxic and Hazardous Wastes, Technomic
lishing Co., Lancaster, PA. 1984. p 318-330,
6 ref.

Descriptors: *Chemical treatment, *Heavy m
*Alum, *Aluminum, *Sodium compounds, M
Chromium, Cadmium, Industrial wastes, Co
Lead, Aulenbach, Nickel, Beryllium, Mer
Zinc, Thallium, Phosphorus removal, Waste
treatment, Industrial wastewater.

The removal of heavy metals by alum or so
aluminate used for P removal was studied in
publically owned treatment works in Mass
setts - the Pittsfield, Medfield and the Fitch
By measuring the heavy metals concentratio
the plants during late summer when the Al
added and continuing measurement after the
continuance of Al salt addition, any differen
heavy metals removal may be attributed to
discontinuance of the Al salt addition. R
showed that the addition of alum or sodium a
nate at dosages which effectively remove phos
rus can remove Cu, Cr and Pb in wastewater
the remaining metals analyzed, no difference
observed with and without Al salt addition fo
or Sb, nor was there any difference in TO
moval. Hg was effectively removed to belo
detection limit by primary sedimentation,
further removal was achieved during secon
treatment when the alum/aluminate was a
The remaining metals analyzed (Ni, Be, Tl)
not present above the detection limits in the
influents, and hence their removal could n
evaluated. (Geiger-PTT)

/86-02108

XPERIMENTAL STUDY OF THE EFFEC-IVENESS OF ALUMINUM CHLORIDE FOR LARIFYING WASTEWATER,
illanova Univ., PA. Dept. of Chemical Engineer-g.
M. Courtney, and D. D. Joye.
: Toxic and Hazardous Wastes, Technomic Pub-hing Co., Lancaster, PA. 1984. p 343-350, 3 tab, ef.

escriptors: *Aluminum chloride, *Clarification, ost analysis, *Food-processing wastes, *Floccu-ion, Aluminum, Ferric chloride, Alum, Industri-wastewater, Chemical precipitation, Wastewater atment, Turbidity, Chemical coagulation, Cost lysis, Industrial wastes.

e effectiveness of aluminum chloride for clarify- wastewater was determined relative to two lely used inorganic coagulating/flocculating nts, alum and ferric chloride. Actual stewater samples, prior to treatment, were ob-ed from a municipal treatment plant and sever-ndustrial food processing plants. The perform-e of the flocculating agents was evaluated on basis of turbidity reduction and sludge volume tandard jar tests and settling cones. The results his study showed aluminum chloride to be in t cases as effective as alum or ferric chloride at mum dosage. When economics are considered, minum chloride may be an attractive replace-t for currently used inorganic flocculating nts in the treatment of industrial wastewater. thor)
5-02109

VENT INTERACTIONS WITH COMPLEX, NCENTRATED INDUSTRIAL STEWATERS,
gers - The State Univ., Piscataway, NJ. Dept. hemical and Biochemical Engineering.
M. Ollinger, and R. C. Ahlert.
Toxic and Hazardous Wastes, Technomic Pub-ng Co., Lancaster, PA. 1984. p 384-394, 5 fig, 2 4 ref.

riptors: *Leachates, *Phenols, *Chemical re-ns, *Industrial wastewater, *Organic solvents, strial wastes, Landfills, Wastewater treatment, bility, Solvents, Separation techniques, ns.

presence of components of a landfill leachate e matrix alters the distribution of phenol and orophenol between organic and wastewater e. The alteration is more pronounced with ol than with o-chlorophenol due to solute-salt actions in the aqueous phase which is favored henol. The components in the leachate solute x that contribute to the salting out of phenol, e greatest extent, appear to be the large inor- anions (carbonate and sulfate ions). High ntrations of these anions in the leachate stem the pretreatment process. High levels of , propionic, and butyric acids also contribute observed change in the phenol distribution. ility studies are needed to determine in which salt effects are more pronounced. (Geiger-

02111

STIGATION INTO THE WATER QUAL-BENEFITS OF CHLORINATING PAPER- EFFLUENTS,
lvania Dept. of Environmental Resources, burg.
Shertzer, and R. F. Frey.
oxic and Hazardous Wastes, Technomic Pub- Co., Lancaster, PA. 1984. p 395-410, 4 fig, 6 ref.

ptors: *Chlorination, *Coliforms, ewater treatment, *Pulp wastes, *Water , Chlorine, Biological properties, Water pol- effects, Macroinvertebrates, Industrial , Aquatic bacteria, Industrial wastewater, cal properties, Escherichia coli, Klebsiella,

The effectiveness of chlorine addition in the control of coliform bacteria in two treated papermill wastewater discharges, and in the east branch of Brandywine Creek, Pennsylvania, was examined along with chemical and biological changes in the creek due to chlorination. Eleven sampling stations were established to assess water chemistry, bacteriology, and aquatic biology from July to October 1982. Results showed that significant reductions in bacteria density during chlorination occurred only at Station 3. The densities of both Klebsiella and E. coli in the effluents of both papermills were reduced after the application of chlorine. No significant improvement in water quality is documented as a result of chlorination of the papermill effluents. Neither metals discharged from the mills, nor total residual chlorine exerted a toxic influence on aquatic macroinvertebrates. Under such conditions, the instream biological community is already somewhat limited by other discharge components making any impact attributable to chlorine difficult to detect. (Geiger-PTT)
W86-02112

CASE HISTORY - OPTIMIZATION OF DISSOLVED AIR FLOTATION SLUDGE THICKENER REDUCES SLUDGE TREATMENT COSTS BY ELIMINATING ADDITIONAL DEWATERING PROCESS,
J. Wozniak, and T. L. Collett.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 411-417, 3 fig.

Descriptors: *Biological wastewater treatment, *Sludge drying, *Cost analysis, *Polymers, *Oil refineries, Operating costs, Maintenance costs, Wastewater treatment, Industrial wastes, Dewatering, Sludge thickening.

In 1983, a program was initiated to reduce the costs of biological sludge treatment at a Northeast crude oil refinery and chemical plant known as the Conservation Area. The biological sludge was thickened by an optimized Dissolved Air Flotation unit (DAF). A Gravity Belt Filter Presses (GBFP's) dewatering step was eliminated, reducing overall treatment costs by $900 thousand per year. The DAF thickening performance was increased about 50%. Mechanical and polymer changes allowed for easier process start-up and a 25% capacity increase. After optimization, the final sludge concentration was consistently 10-12% total solids. The optimized in-line dilution of polymer significantly reduced costly equipment, maintenance and operator time. About one-third of the total cost savings realized represents the polymers no longer used in the GBFP's. The maintenance cost savings was about one-third of the total savings and the remaining savings were attributed to the energy costs required by the GBFP's, the polymer dilution system and the building where everything was located. (Geiger-PTT)
W86-02113

BELT FILTER PRESS SELECTION FOR CHEMICAL PROCESS WASTE BIOSLUDGES,
Du Pont de Nemours (E.I.) and Co., Wilmington, DE.
K. N. Wood, and E. L. Mongan.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 418-432, 7 fig, 3 tab, 20 ref.

Descriptors: *Sludge drying, *Sludge, *Flocculation, *Sludge conditioning, *Sludge filters, Dewatering, Wastewater treatment, Sludge solids, Drying.

The design features and unique concepts employed by the various belt filter presses (BFP) used for sludge dewatering at the DuPont facilities are described. The belt press consists of a three-stage process: sludge flocculation, gravity drainage of free water, and belt pressing of dewatered sludge. Some presses offer an extra high pressure zone which is advantageous with fibrous or inorganic sludges. The Flocpress accomplishes flocculation in a rotary drum. An earlier version of the Unimat has V-shaped pockets for gravity drainage. The R. B. Carter Company BFP uses a rotating drum for flocculation and a screen-lined drum for thickening. The Klampress flocculates sludge by passing it through a vortex mixer. Testing methods of BFP's should involve selection of effective polyelectrolytes for sludge conditioning, determining mixing time and energy requirements for flocculation, recording rate and quantity of filtrate release by gravity drainage and by compression dewatering, and calculating filter cake dryness. It is suggested that more than one press manufacturer's equipment be evaluated on-site, and ample startup time be allowed for finetuning of the polymer addition system, belt tracking and other potentially tempermental aspects of the belt filter press installation. (Geiger-PTT)
W86-02114

MODELING OF REACTIONS BETWEEN AQUEOUS CHLORINE AND NITROGENOUS COMPOUNDS,
Massachusetts Dept. of Environmental Quality Engineering, Westborough. Div. of Water Pollution Control.
R. A. Isaac, and J. C. Morris.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 63-75, 5 fig, 5 tab, 9 ref. DAMD 17-77-C-7051.

Descriptors: *Wastewater treatment, *Chlorination, Fate of pollutants, Model studies, Chloramines, Nitrogen compounds, Amino acids, Organic compounds, Decomposition, Chemical reactions.

A computer model is used to predict the relative amounts of selected chloramines in wastewaters. Common organic nitrogen compounds in wastewater are methylamine, di- and trimethylamine, and the amino acids. The ratio of organic N to total N in wastewaters is 0.45-1.00, median 0.92. Results show that the nature of the organic nitrogen is an important factor in the chloramine/organic-NCl distribution. In the case of glycylglycine it is likely that the amine-N and not the amide-N is being chlorinated. Decomposition of chloramines was studied by pouring a solution of HOCl into a rapidly stirred solution of the nitrogenous compound and monitoring disappearance by titrimentry or spectrometry. Half-lives (in min) of chloramines (with varying pH and temperatures) of the following compounds were as follows: alanine, 76-96; glycine, 1300-9000; histidine, 34-79; leucine, 66-79; phenylalanine, 52; serine, 33-72; tryptophan, too fast to measure; creatinine, 3300; glycine-N-acetyl ester, 19,000; glycine ethyl ester, 53-945; glycylglycine, 930-14,000; sarcosine, 192-257; and sarcosine anhydride, 2,900-12,900. Calculations show that low concentrations of dichloramine enhance disinfection but organic chloramines have no practical value in disinfection. (Cassar-PTT)
W86-02137

NATURAL DECHLORINATION KINETICS OF SECONDARY MUNICIPAL EFFLUENTS,
Beak Consultants Ltd., Mississauga (Ontario).
M. P. Shaw, and W. J. Snodgrass.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983, p 113-123, 3 fig, 2 tab, 20 ref.

Descriptors: *Wastewater treatment, *Fate of pollutants, *Chlorination, *Kinetics, Ponds, Design criteria, Wastewater ponds, Ultraviolet radiation, Organic matter.

The chemical kinetics of dechlorination in a natural wastewater dechlorination pond were investigated, considering temperature, ultraviolet radiation, and organic concentration. The kinetic constants delta = 0.00056 per min and gamma = 3270 degrees K should be used in the modified Arrehenius equation to predict the first-order rate constants describing natural dechlorination kinetics. Chlorine concentration should be computed in molar values. Dechlorination pond design should be based on the slowest expected kinetics, which occur in winter with ice cover. Atmospheric levels of ultraviolet radiation roughly double the first-order rate constant. (Cassar-PTT)

W86-02142

CHLORINE DEMAND: STUDIES CONCERNING ITS CHEMICAL BASIS,
Maryland Univ., College Park. Dept. of Chemistry.
For primary bibliographic entry see Field 5F.
W86-02147

FORMATION OF ORGANOHALOGEN COMPOUNDS IN CHLORINATED SECONDARY WASTEWATER EFFLUENT,
Florida International Univ., Miami. Drinking Water Quality Research Center.
For primary bibliographic entry see Field 5B.
W86-02169

NONVOLATILE ORGANICS IN DISINFECTED WASTEWATER EFFLUENTS: CHEMICAL CHARACTERIZATION,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W86-02170

FORMATION OF VOLATILE HALOORGANIC COMPOUNDS IN THE CHLORINATION OF MUNICIPAL LANDFILL LEACHATES,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02171

WATER SUPPLY AND SANITATION IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 5F.
W86-02324

REGIONALIZATION OF WATER SUPPLY AND SANITATION SERVICES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W86-02326

SEWERAGE: THE DEVELOPING COUNTRY DILEMMA,
Cole and Co. Ltd., Ottawa (Ontario).
M. G. McGarry.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 125-141, 1 fig, 3 ref.

Descriptors: *Sewer systems, *Wastewater treatment, *Cost-benefit analysis, *Developing countries, *Sanitation, Sewers, Maintenance costs, Cost analysis, Public health, Project planning, Wastewater disposal, Waste management, Economic aspects.

In the mid-nineteenth century many American and European cities had to construct sewers to handle problems of wastewater disposal. Whereas sewerage and treatment plants are being designed today to overcome environmental pollution problems of the industrialized states, the problems facing the large low-income populations of developing countries are human health-related. Usually consultants to planning projects in developing countries come from already developed nations, and these consultants have little experience with alternatives to sewerage. A cost-benefit analysis of projects to provide sewerage to Taipei, Taiwan is given to illustrate the difficulties involved in making such an assessment. Three costs of sewerage that are often overlooked are the cost of flush water, loss of the reuse potential of excreta, and increased costs for treatment of receiving waters for sewage. The necessary health education programs needed to improve hygiene in the home rarely accompany the introduction of sewerage. Community support in the education of people in sanitary practices is essential. Although technical alternatives to sewerage are now available, it will take many more years before effective delivery mechanisms are in place and operating. Plans for sewering a city center do not usually address the health problems of peripheral squatter settlements. (Geiger-PTT)

W86-02332

WET METHOD FOR EXCRETA DISPOSAL,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
R. L. Droste.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 157-176, 6 fig, 1 tab, 34 ref.

Descriptors: *Septic tanks, *Wastewater disposal, *Seepage pits, *Developing countries, *Sludge disposal, Waste disposal, Sewer systems, Septic sludge, Septic wastewater, Seepage, Evapotranspiration, Leaching, Economic aspects, Public health, Sanitation, Social aspects.

Financial and economic costs of wet methods for excreta disposal are less than those of a full sewerage system. The aqua-privy (AP) can handle feces and urine, with an input of water. The AP consists of a drop pipe from the toilet and a nonbaffled container discharging to a soakaway. The tank is mainly sized on the basis of the long-term buildup of solids. Since the failure to maintain the water seal is often the reason for AP failure, the addition of sullage is recommended as a design standard. Sludge levels in the AP should be checked annually. The septic tank system also relies on the on-site disposal of wastes. Estimation of the quantity of wastewater flow is the critical factor in the sizing of septic tanks. The most common means of effluent disposal is in seepage or leaching fields. The most important characteristic of the disposal field is its hydraulic conductivity. Septic tanks, AP and their leaching fields must be located away from wells, streams, and buildings. If impermeable rock or soils of low permeability exist, the evapotranspiration bed appears to be a feasible alternative. Communal toilets are often unacceptable due to inconvenience and lack of proper cleaning. Health problems may arise if sludge cleaning is not performed, water seals are not maintained, or seepage fields become clogged. The success of any system relies its acceptance by its users. (Geiger-PTT)
W86-02333

LOW-COST ALTERNATIVES TO SEWERAGE,
Cole and Co. Ltd., Ottawa (Ontario).
M. G. McGarry.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 143-156, 7 fig, 13 ref.

Descriptors: *Latrines, *Septic tanks, *Wastewater disposal, *Developing countries, *Sludge disposal, Waste disposal, Solid waste disposal, Economic aspects, Public health, Sanitation, Social aspects, Design criteria.

The main cause of failure of latrinization programs in the past are social and educational failure. The conventional pit latrine has been advocated by aid programs and colonial governments as part of health care projects. In dense squatter settlements, redigging of the pits after several years may cause problems in areas where there is already limited space. The vented improved pit latrine has its pit offset and a vent pipe rising from the pit's concrete cover slab. Pit desludging is done by the municipality. The revised earth closet has alternating pits to increase the capacity for storage and lengthen the time between desludging. Once filled, the first pit is closed and its contents left to digest while the superstructure is placed above the second pit. The Reed's odorless earth closet has the pit offset from the superstructure by using a straight or curved chute. This latrine is not recommended because the chute often becomes clogged. The Mozambiquan latrine is made of cement and is designed as a circular slab located over a circular pit. This type of latrine is well suited to areas where raw materials are scarce and the subsoil is unstable. The principal elements of the pour-flush latrine are the bowl, trap, and pipe. The bowl is designed to be flushed with 1-2 liters of water poured by hand. The pour-flush latrine provides a water seal between the household and the excreta storage pit. The vacuum truck and vault system collects excreta and stores it beneath the toilet for regular collection by the municipality. (Geiger-PTT)

W86-02334

EXCRETA REUSE OPTIONS: COMPOSTIN AND BIOGAS,
Waterloo Univ. (Ontario). Dept. of Civil Engine ing.
R. L. Droste.
IN: Water Supply and Sanitation in Developi Countries, Ann Arbor Science, Ann Arbor, M 1982. p 177-200, 5 fig, 5 tab, 39 ref.

Descriptors: *Recycling, *Waste disposal, *Co posting, *Biogas, *Sludge digestion, Anaerobic gestion, Sludge disposal, Economic aspects, Ae bic digestion, Social aspects, Methane, Waste m agement, Digestion, Fertilizers, Sludge utilizati

Reuse options for excreta disposal help solve pr lems of waste disposal while turning a waste int resource. Compost latrines have not met w widespread success, due to improper user attitud Compost units can be designed for continuous batch operation. The aerobic processes are usua continuous and centered around the Swed design known as the Clivus Multrum. Outside the Swedish experience with multrums, the ba type anaerobic composters have achieved the m significant success, especially in developing co tries. Certain sociocultural factors have to be c sidered for composting to be successful. User e cation and care are needed. The users must willing to handle the composted humus, and th must be a market or local use for the produ Lime or ash addition is preferable in double-va latrines because of their odor-absorption capab ties. Definitive health studies on pathogen survi in composted wastes are lacking. Most data po to the survival of viruses and helminths, especia Ascaris. A minimum one-year retention time recommended for essentially complete kill. Ana obic digestion under suitable conditions for bio production does not render an effluent slurry su ciently low in pathogen content for use as ferti er. A brief review of the theory and principles anaerobic sludge digestion confirms the limits the process. Use of biogas energy is conside along with operation and design of digest (Geiger-PTT)
W86-02335

OXIDATION PONDS AND FISH CULTURE,
Cole and Co. Ltd., Ottawa (Ontario).
M. G. McGarry.
IN: Water Supply and Sanitation in Develop Countries, Ann Arbor Science, Ann Arbor, 1982. p 201-218, 4 fig, 19 ref.

Descriptors: *Fish farming, *Aquaculture, *Oxi tion ponds, *Public health, *Waste disposal, Slu utilization, Anaerobic digestion, Aerobic digesti Wastewater treatment, Carp, Oxidation proc Wastewater disposal, Viruses, Pathogenic bacte Parasites, Pathogens, Coliforms, Developing co tries.

The oxidation pond has become widely recogni as the most efficient, least costly method of mary and secondary treatment of wastewat Conventional oxidation ponds are classified three types: anaerobic, facultative and maturati The advantages of using anaerobic, facultative maturation ponds in tropical developing count are numerous. Untreated wastewater can be directly into facultative ponds, where wastes treated both anaerobically and aerobically. Ma ration ponds are placed after a series of facultat ponds and usually recieve effluents below 75 m grams/liter BOD. Land requirement for tot facultative and maturation pond systems can considerably reduced by placing anaerobic po in front of the first facultative pond. To maxim algae production for use as animal feed, oxidat ponds can be operated at detention periods of days and depths of 20-40 cm as high-rate a ponds. In East Asia, the practice of raising fish nightsoil (domestic excreta) is common. The in duction of fish to sewage-fed oxidation ponds portedly increases the quality of the final efflu Well designed and operated oxidation and mat tion ponds can achieve significant viral remov Fish resist penetration of viruses into their mu

issue while shellfish do not. Pathogenic bacteria may penetrate the meat of fish and cause health problems in improperly cooked fish. Series oxidation ponds are capable of efficient removal of many human parasites. (Geiger-PTT)
W86-02336

COST-EFFECTIVE WATER SUPPLY AND SANITATION PROJECTS FOR DEVELOPING COUNTRIES,
International Bank for Reconstruction and Development, Washington, DC. Dept. of Transportation and Water.
For primary bibliographic entry see Field 6C.
W86-02337

SANITATION ASPECTS OF WATER SUPPLY AND EXCRETA DISPOSAL,
Ministry of Health, Lilongwe (Malawi).
For primary bibliographic entry see Field 5E.
W86-02340

OPERATION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS,
Walker and Partners Ltd., Ottawa (Ontari).
J. Grover.
In: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 327-341, 8 fig, 1 ref.

Descriptors: *Maintenance, *Project planning, *Wastewater treatment, *Water supply development, *Sanitation, Evaluation, Management planning, Future planning, Maintenance costs, Developing countries, Manpower, Economic aspects, Water supply, Education.

In order to operate properly, water supply and sanitation systems must receive the proper maintenance. Planned maintenance attempts to anticipate and avoid interruptions of service. Breakdown maintenance, a form of crisis intervention, tries to restore service in malfunctioning systems as quickly as possible. In a survey conducted by the General Accounting Office which showed failure of the majority of wastewater treatment plants to meet water discharge standards, the lack of proper maintenance was cited as the second most frequent cause of failure. In developing countries, systems are frequently broken down. Local resources are usually all that is needed to keep a hand pump water supply system in operation. The United Nations Children's Fund conducted an educational program on the maintenance of water supplies. Piped water supplies that involve treatment and pumping are also very vulnerable to failure in rural areas. To keep water and wastewater systems operating properly, the agency responsible for maintenance must have reliable transport fleet. When planning, financing, construction and operation of system are all undertaken locally, local personnel can handle any maintenance problems. Design criteria should consider local customs and the use of locally available materials. For the effective operation and maintenance of water and sanitation systems, motivation, good management, money and power must be present. In planning new water supply and sanitation projects, the planner should first evaluate what is wrong with the present system. (Geiger-PTT)
W86-02341

Ultimate Disposal Of Wastes

PHYSICAL PROPERTIES AND LEACH TESTING OF SOLIDIFIED/STABILIZED INDUSTRIAL WASTES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-147983, Price codes: A07 in paper copy, A01 in microfiche. EPA-600/2-82-099, December 1982. 135 p, 21 fig, 15 tab, 15 ref, 3 append. EPA-IAG-D4-0569.

Descriptors: *Sludge treatment, *Waste disposal, Industrial wastes, *Leaching, Landfills, Metals, Heavy metals, Waste treatment, Toxic wastes, *Waste stabilization, *Water pollution control.

Physical property and leaching tests were conducted to assess the engineering characteristics and pollution potential of five industrial wastes (sludges from electroplating, Ni-Cd battery manufacture, pigment production, chlorine production brine, and glass etching). Four solidification/stabilization processes were used to produce different types of treated-waste products: (1) one resembling low-strength concrete, (2) a rubber-like solid, (3) a solid plastic-encased block, and (4) a soil-like material. No correlation between the physical properties of the treated products and their ability to contain the sludge constituents in leach testing was found. The soil-like product had the highest permeability and lowest strength and durability, but it gave the best overall containment of all the treated-waste products except the polyethylene-jacketed waste. Although the rubber-like solid was strong and durable, it produced the leachate with the highest concentration of pollutants. Leach tests were conducted with carbon dioxide-saturated water at a flow rate of 0.00005 cm/sec for 1-2 years. In all cases leachates were higher in heavy metals and anions than drinking water standards. No treatment process other than plastic encapsulation uniformly reduced the concentration of all potential pollutants for all sludge types; however, the overall pollution potential was lowered. In some cases, additional leachable materials were added in the treatment process. Some treatment processes increased the solubility of certain constituents so that they were lost at higher rates than in untreated sludge. (Cassar-PTT)
W86-02001

HAZARDOUS AND TOXIC WASTES: TECHNOLOGY, MANAGEMENT AND HEALTH EFFECTS,
For primary bibliographic entry see Field 5B.
W86-02041

OPERATING EXPERIENCE IN HAZARDOUS WASTES DISPOSAL BY POZZOLANIC CEMENTATION,
Envirosafe Services, Inc., Horsham, PA.
C. L. Smith, and T. Longosky.
IN: Hazardous and Toxic Wastes: Technology, Management and Health Effects, The Pennsylvania Academy of Science, Easton, PA. 1984. p 64-76, 3 fig, 7 tab, 10 ref.

Descriptors: *Waste disposal, *Cement, Pozzolanic cementation, Landfills, Envirosafe process, Organic compounds, Sludge, Paper coating industry, Steel industry, Metal-finishing industry, Oil, Fly ash, Encapsulation.

A pozzolanic cementation process has been used for hazardous waste disposal by the Envirosafe Services facility, Honeybrook, Pa., since early 1980. Fly ash is blended with the waste, then lime is added. The basic chemistry is similar to that of portland cement hydration and hardening, producing a material of high compressive strength with permeability coefficients in the range of 10 to the minus 6 power cm/sec. The processed waste, with the consistency of damp soil, is trucked to a landfill, where it is spread, graded, and compacted. Essentially zero leachate is generated by the landfill, and no impact on monitoring wells has been detected. Some wastes are not suitable for this process, notably those with high sugar content. Specific details are given for several wastes: paper coating wastes (50% complex organics with inorganic pigments and clays), air pollution residue from steel production (zinc, iron, calcium), and rolling mill oil-bearing sludge (quartz, oil and grease, heavy metals). (Cassar-PTT)
W86-02042

GEOLOGICAL FACTORS IN DISPOSAL SITE SELECTION,
Pennsylvania State Univ., University Park. Dept. of Geosciences.
R. F. Schmalz.
IN: Hazardous and Toxic Wastes: Technology, Management and Health Effects, The Pennsylvania Academy of Science, Easton, PA. 1984. p 124-136, 52 ref.

Descriptors: *Waste disposal, *Water quality control, *Landfills, *Geology, Geohydrology, Soil properties, Groundwater movement.

Reinforced concrete vaults and other man-made containers for burial of hazardous waste have failed within 20 or 30 years in many instances. Therefore, proper selection of a suitable geological site is very important for long-term safe storage. Essential criteria for a successful shallow land burial site are as follows: (1) sufficient depth of soil or regolith to accomodate the burial cells, (2) a water table of sufficient depth to guarantee that the cells are above the zone of saturation at all times, (3) a surface water regimen which allows drainage away from the cells, (4) soil or regolith which is homogeneous and impermeable so that groundwater flows aways from the site, and (5) a stable geological environment. Guidelines are given for choosing or excluding a site for hazardous waste disposal. A four-level process is used to quickly eliminate unsuitable sites from consideration. The first level excludes sites on a regional basis (volcanic activity, flood plains, population centers, permeable bedrock, etc.). The second level considers site-specific problems (eliminating places subject to exceptional storms, landslides, local areas of fractured rock, steep slopes, mines, usable aquifers). Interactive site-specific criteria consider interrelationships between two or more factors, such as soil transmissivity and depth to water table. Factors which enhance the suitability of a site for waste disposal include transportation facilities, backfill sources, and absorbant or neutralizing soil. (Cassar-PTT)
W86-02043

TIME PERSPECTIVE IN THE SUBSURFACE MANAGEMENT OF WASTE,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 5B.
W86-02044

SITING HAZARDOUS WASTE MANAGEMENT FACILITIES: THEORY VERSUS REALITY,
Boston Univ., MA. Dept. of Urban Affairs and Planning.
For primary bibliographic entry see Field 5G.
W86-02045

COAL TAR WASTES: THEIR ENVIRONMENTAL FATE AND EFFECTS,
Pennsylvania Power and Light Co., Allentown.
For primary bibliographic entry see Field 5B.
W86-02046

TOXIC AND HAZARDOUS WASTES,
For primary bibliographic entry see Field 5D.
W86-02094

UTILIZATION OF AN INDUSTRIAL WASTE OIL AS AN ALTERNATIVE FUEL FOR A MUNICIPAL SLUDGE INCINERATOR,
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 5D.
W86-02099

BIOLOGICAL TREATMENT OF INDUSTRIAL WASTEWATERS IN THE USSR,
American Standards Testing Bureau, Inc., New York.
For primary bibliographic entry see Field 5D.
W86-02100

FACILITY UPGRADES DUE TO HAZARDOUS MATERIALS REGULATIONS,
GTE Government Systems Corp., Mountain View, CA. Sylvania Systems Group-Western Div.
For primary bibliographic entry see Field 5D.
W86-02101

FIXATION OF SEWAGE SLUDGE AND FLY ASH; AN ALTERNATIVE METHOD FOR OCEAN DISPOSAL,
State Univ. of New York at Stony Brook.
C-S. Shieh, and F. J. Roethel.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 433-443, 5 fig, 3 tab, 15 ref.

Descriptors: *Solid waste disposal, *Ocean dumping, *Sludge disposal, *Fly ash, *Mine wastes, Waste disposal, Sludge drying, Sludge conditioning, Dewatering, Sludge thickening, Reefs, Chemical properties.

The Coal Waste Artificial Reef Program (C-WARP) has proven the environmental acceptability of waste stabilization and ocean dumping of dewatered sludge mixed with fly ash while forming an artificial reef for fishing. Test samples of solid cylinders (11.9 cm by 10.2 cm) or a fly ash-sewage sludge (FA-SS) mixture were tested for permeability, compressive strength, electron microscopic appearance, and chemical properties (elemental analysis). Results showed that the compressive strength of the FA-SS block was a function of curing time, temperature, moisture, and additive contents. Scanning electron micrographs of sewage sludge indicate that the sludge is composed of an irregular flaky material. Permeabilities ranged from 0.00001 to 0.000001 cm/sec over the periods of the experiment. Concentrations of Al, Cu, Zn and Pb in the exterior portions of the FA-SS blocks increased with time after exposure to seawater while a steady decrease of Cd was also observed. These findings show that blocks maintain their structural integrity and may provide an acceptable option for ocean dumping of solid wastes. (Geiger-PTT)
W86-02115

DEALING WITH LANDFILLED HAZARDOUS SLUDGE, OTHER ALTERNATIVES,
Maryland Dept. of Health and Mental Hygiene, Baltimore. Office of Environmental Programs.
G. Z. Francis.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 444-455, 4 fig, 3 tab.

Descriptors: *Groundwater pollution, *Landfills, *Leachates, *Sludge disposal, *Water pollution prevention, Leaching, Waste disposal, Solid waste disposal, Water quality, Industrial wastes, Calcium carbonate, Nickel, Boreholes, Acid rain, Cost analysis.

A study was conducted to test leachate and groundwater quality of a major industrial facility in Maryland. The landfilled sludge consists of a mixture of three types of wastes: electroplating sludges, paint residues, and industrial painting wastewater treatment sludges. Twelve boreholes were drilled in the vicinity of the disposal site and groundwater monitoring wells were installed in five of these boreholes. Groundwater was monitored continuously for three months. No evidence of groundwater quality deterioration was observed over a 4-yr period, although natural precipitation was suspected as a source of leachate for Ni. It was recommended that the site be closed and a 1-inch layer of calcium carbonate be applied to its surface to neutralize acid precipitation in the facility's area for more than 800 years. Total closure cost is estimated at $100,000 to $120,000 while digging out the waste and disposing of it by some other means would cost an estimated $900,000 to $1,000,000. (Geiger-PTT)
W86-02116

ENVIRONMENTAL AND ENGINEERING ASPECTS RELATED TO THE RESTORATION OF A FERROUS SULFATE (COPPERAS) WASTE DISPOSAL SITE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
W. R. Knocke, J. T. Novak, G. L. Goodman, M. Morris, and J. Moslehi.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 487-496, 2 fig, 3 tab, 2 ref.

Descriptors: *Solid waste disposal, *Landfills, *Leachates, *Ferrous sulfate, *Groundwater pollution, Waste disposal, Acidic water, Land disposal, Sulfates, Linings, Leaching, Water pollution sources, Environmental effects, Water pollution effects, Cleanup, Clays.

An assessment of environmental damage associated with the burial of waste ferrous sulfate or copperas at an abandoned Ti processing facility in Nelson County, Virginia and related engineering improvements associated with the sites cleanup was made in the summer of 1983. Results showed extreme cracking of the top clay liner which allowed rainfall to percolate directly into the buried copperas. The extremely acidic surface seepage erradicated all vegetation with which it came in contact. Evaluations of soluble Al concentrations in roundwater showed a significant change in the mineralogical structure of contaminated soils which was hypothesized to be directly related to the release of Al during acidic decomposition of the soil matrix. An increase in permeability as a function of exposure time to copperas leachate could also occur. River water samples collected along the Piney River both upstream and downstream of all identified surface runoff locations at the plant site, showed significant decreases in pH due to groundwater contamination. Laboratory tests show increased permeabilities of clay lining materials due to copperas. Remedial action included regrading the surface, depositing a 2-ft clay cover and planting vegetative cover to aid in rainfall drainage and evapotranspiration. (Geiger-PTT)
W86-02117

CONSTRUCTION TECHNIQUES FOR REMEDIAL DESIGN AT A CONNECTICUT SUPERFUND SITE: A CASE STUDY,
Hart (Fred C.) Associates, Inc., New York.
For primary bibliographic entry see Field 5G.
W86-02118

PREDICTING LEACHATE GENERATION IN LANDFILLS: A NEW METHOD,
Anderson (James C.) Associates, Camden, NJ.
J. R. Gee.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 548-567, 4 fig 8 tab, 21 ref. C2521NASX.

Descriptors: *Landfills, *Lysimeters, *Leachates, *Percolation, *Mathematical equations, Models, Simulation analysis, Leaching, Soil water, Statistical analysis, Computer models, Model studies, Waste disposal.

A summary of part of a research effort to develop a more direct method of landfill percolation prediction based on the percolation process itself rather than on the processes surrounding it is presented. Factors were selected for measurement which could be easily measured in the field. They are: rainfall amount, initial soil moisture content, soil density, slope, and runoff. Using a specially designed rainfall simulator and lysimeters, laboratory testing of five different landfill cover soils were carried out. Rainfall simulator data was analyzed using the MINITAB statistical computer program. An extensive nuumber of linear equations were analyzed to find a good relationship between the variables selected. In addition to the equations generated, the Thornthwaite Water Balance, HELP and HSSWDS computer models were also used to predict leachate generation at Cell 1 of the Madison solid waste lysimeters from 1972 to 1975. Predicted values from both the physical and non-physical rainfall simulator models and their laboratory determined coefficients showed better accuracy than existing water balance methods on a monthly and yearly basis. (Geiger-PTT)
W86-02122

HAZARDOUS WASTE MANAGEMENT FOR THE 80'S.
Ann Arbor Science, Ann Arbor, MI. 1982. Edited by T. L. Sweeney, H. G. Bhatt, R. M. Sykes, and O. J. Sproul. 553 p.

Descriptors: *Waste disposal, *Waste management, *Groundwater pollution, *Industrial wastes, *Waste identification, *Landfills, On-site investi tions, Cleanup operations, Legal aspects, Fi tests, Groundwater, Environment, Polluta Aerial photography, Water, Leachates, Mathen ical models.

A series of papers reflecting current work on c cal issues in hazardous waste management (incl ing groundwater and seepage; treatment, stor and disposal; site cleanup; and safety and le considerations) is presented. A variety of indust contaminants are considered, and many pract problems involved in disposal (particularly l disposal) are addressed. Site assessment, conta ment and encapsulation of hazardous waste disp al sites, hazardous waste site cleanup, and reme action for abandoned waste sites are among topics covered. Groundwater monitoring, conta nation and recovery are discussed. Several c histories are presented to illustrate the vari topics. (Halterman-PTT)
W86-02219

CLASSIFICATION AND MANAGEMENT PROCESS WASTES FOR THE TENNESS SYNFUELS ASSOCIATES COAL-TO-GA LINE FACILITY,
R. W. Rittmeyer, J. P. Fillo, D. P. Malik, A. J. Merritt, and J. P. Brennan.
IN: Hazardous Waste Management for the Ann Arbor Science, Ann Arbor, MI, 1982. p 45 4 fig, 7 tab, 9 ref.

Descriptors: *Industrial wastes, *Waste dispo Waste identification, Solid wastes, Solid waste posal, Land disposal, Landfills, Regulations.

A plant proposed by the Tennessee Synfuels A ciates for the production of gasoline from loc available bituminous coal is described, and development of an inventory, preliminary clas cations, and management options for pro wastes expected from the facility are reported. features of the 1976 Resource Conservation Recovery Act which apply to this plant are viewed. For each plant operating area, the gene ed wastes, generation rate and schedule, poten hazard classification, and proposed managem techniques for various wastes are presented in ular form. A schematic for probable waste man ment techniques is included. The information resents best estimates base on current pro design. The facility (50,000 barrels per day ca ity) will generate approximately 4.6 million t year of raw wastes in five categories: coal-deri wastes (77%), organic wastes (4%), byprod (4%), spent catalysts (0.06%), and other wa (15%). In-process management will reduce amount of wastes actually leaving process unit 2.4 million tons/year, 87% of which will be d derived. Hazardous wastes will be subjected routine analysis and non-hazardous wastes wil analyzed at least annually. (Halterman-PTT)
W86-02220

DETERMINATION OF DISPOSAL SITES F PCB CONTAMINATED MATERIAL DREDG FROM THE HUDSON RIVER BED,
Pirnie (Malcolm), Inc., Paramus, NJ.
J. S. Reed, and J. C. Henningson.
IN: Hazardous Waste Management for the Ann Arbor Science, Ann Arbor, MI, 1982. p 81 2 fig, 2 tab, 6 ref.

Descriptors: *Dredging, *Spoil banks, *Waste posal, Hudson River, Land disposal, Environm Field tests, On-site investigations, Polychlorin biphenyls.

The selection process used in locating a site disposal of PCB-contaminated material obta from two Hudson River dredging projects is scribed. The five steps in the approach are scribed in detail. The steps are: developmen siting criteria; preparation of overlays using t graphic maps as a base; delineation of specific within the environmentally acceptable 'windo conduction of preliminary field visits; and con tion of detailed field investigations. Public par pation and response was also included in this st The detailed field investigation of the prefe

site included soil borings, a resistivity survey, and test pit investigations. This approach resulted in a site which meets or exceeds both State and Federal standards. (Halterman-PTT)
W86-02221

ROLE OF THE ANALYTICAL LABORATORY IN HAZARDOUS WASTE MANAGEMENT,
Harmon Engineering and Testing, Auburn, AL.
V. K. Varma, B. B. Ferguson, and M. S. Shearon.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI, 1982. p 115-141, 2 fig, 3 tab, 11 ref.

Descriptors: *Industrial wastes, *Waste disposal, *Waste identification, *Environment, Waste management, Groundwater, Laboratories, Regulations, Legal aspects.

Several aspects of the role of the analytical laboratory in hazardous waste management are addressed, including examination of selected analytical considerations, presentation of selected case studies, and guidelines for obtaining laboratory services. The functions of the analytical laboratory within the Hazardous Waste Management (HWM) system of the Resource Conservation and Recovery Act (RCRA) fall into three categories: waste identification; waste and waste constituent monitoring; and treatment, clean-up and other certifications. Programs which have been developed specifically for meeting the compliance objectives of the HWM system are described in detail. These programs include waste identification, delisting of waste sources and specific wastes, groundwater monitoring plans, and waste analysis plans. The analytical chemistry considerations discussed include sample collection and preservation, analytical interferences, instrumentation, and quality control. Three case studies illustrate the role of the analytical laboratory in the HWM system decision-making process. (Halterman-PTT)
W86-02222

EMEDIAL ACTION ALTERNATIVES FOR BANDONED HAZARDOUS WASTE SITES,
or primary bibliographic entry see Field 5G.
'86-02225

LURRY TRENCH CUTOFF WALLS FOR AZARDOUS WASTE ISOLATION,
or primary bibliographic entry see Field 5G.
'86-02226

LAY LINER PERMEABILITY - A PROBABI-STIC DESCRIPTION,
arnegie-Mellon Univ., Pittsburgh, PA.
O. Harrop-Williams.
: Hazardous Waste Management fr the 80's, Ann rbor Science, Ann Arbor, MI, 1982. p 307-314, 2 , 13 ref.

escriptors: *Landfills, *Waste disposal, *Permeility coefficients, *Mathematical models, Model dies, Liquid wastes, Solid wastes, Environment.

e primary criterion used in evaluating the suitlity of hazardous waste landfills for containing zardous waste is permeability, and many regulay agencies have adopted regulations requiring y-lined hazardous waste landfills to have a coefent of permeability no greater than a fixed ue. However, permeability is one of the most iable of engineering properties and its behavior est described using probability theory. A model leveloped to predict the uncertainty associated h specified permeability values. Using this del, it is possible to establish confidence levels ociated with possible ranges of the coefficients permeability of clay-lined hazardous waste land-. The probability density function of the coeffint of permeability is derived from a microscope w of flow through soils. In developing this del, the permeant was assumed to be a neutral nt (e.g., water). However, as is usually done in y-liner design, this model can be modified to ude the effect of chemicals on the clay. (Halter-PTT)
6-02227

CONTAINMENT AND ENCAPSULATION OF HAZARDOUS WASTE DISPOSAL SITES,
A. A. Metry.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI, 1982. p 315-342, 7 fig, 5 tab, 10 ref.

Descriptors: *Waste disposal, *Landfills, *Environmental engineering, Radioactive wastes, Solid wastes, Environmental effects, Computer models, Environment, Wastes.

State-of-the-art techniques for containment and encapsulation of hazardous waste disposal sites are discussed. Such techniques have been applied as remedial action for inactive hazardous waste disposal sites containing chemical, toxic and low-level radioactive materials. The use of computer simulation for optimization of design features is discussed, and techniques for evaluation of cover, liner and barriers are presented and illustrated. The case history presented is for a large site containing low-level radioactive waste, but can be applied to other types of hazardous waste. Components of the cover system are considered, with 18 cover types being evaluated based on 20 performance criteria. In a discussion of the function of the liner system, 12 materials are evaluated. It is concluded that it is preferred to utilize passive rather than active techniques for encapsulating waste-disposal sites. Multilayer cover systems, soil/clay liners, bentonite slurry walls and ion-exchange barriers represent the basic elements of remedial action that do not require perpetual postclosure operations. (Halterman-PTT)
W86-02228

ESTIMATES OF SEEPAGE THROUGH CLAY COVERS ON HAZARDOUS WASTE LANDFILLS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
S. J. Wright, and C. P. Miller.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI, 1982. p 343-356, 4 fig, 2 tab, 13 ref.

Descriptors: *Waste disposal, *Landfills, *Linings, *Leachate, Model studies, Mathematical models, Wastes, Industrial wastes, Environment.

The importance of estimating the amount of leachate generated in a hazardous waste landfill is stressed, and several methods available for the estimate of leachate rates are described, along with their shortcomings. An alternative method, based on a numerical model and using a more mechanistic approach, is presented. The example is based on a hypothetical landfill, but with meteorological information from a specific location. Three conclusions can be reached. First, the leakage rates through the clay layer are greater than the saturated hydraulic conductivity which is often stated to be the case for fully saturated flow. Leakage rates of four or five times this value can be computed. Second, if the total potential leakage into the clay is of the same order of magnitude as the saturated hydraulic conductivity or less, the liner will accept all downward flow. And third, the thickness of the clay liner only affects the time that it takes for a significant amount of leakage to begin to enter the landfill and has little effect upon the seepage rates. (Halterman-PTT)
W86-02229

MUNICIPAL SOLID WASTE MANAGEMENT FACILITY LOCATION MAPPING: SUPPORT ACTIVITIES REPORT,
Texas Natural Resources Information System, Austin.
Report TNRIS-031, January 1983. 22 p, 5 fig, 2 tab, 2 ref, append.

Descriptors: *Texas, *Waste disposal, *Computer programs, *Waste management, *Solid waste disposal, *Waste dumps, Automation, Municipal wastes, Landfills, Composting, Permits, Maps, *Mapping.

The Texas Department of Health (TDH) was designated by the 'Solid Waste Disposal Act,' Article 4477-7, Vernon's Texas Civil Statutes, as the Texas agency responsible for providing standards for managing the collection, handling, storage, and disposal of municipal solid waste. TDH is empowered by the Act to require and issue permits authorizing and governing the operation and maintenance of sites used for the management (including disposal) of solid waste. The Department has for some time maintained automated records associated with each permit application and each permitted site. Although the geographic coordinates of each existing or proposed site were on the file, no systematic means was available for displaying the site locations by geographic coordinates as computer-generated maps. By including site location data in the TNRIS Geographic Information System (GIS), TDH can display the data along with a variety of other geographic information already included in the GIS. Data can be reproduced at any scale in any of eight available geographic projections. TNRIS System Central staff provided computer software to establish a GIS file which included the type, location, and status of each proposed or existing municipal solid waste management site. Plots of the data have been used by TDH for a variety of purposes including scheduling of public hearings and (in conjunction with maps showing physical and geological features and population) to identify areas of potential concern related to each site. (Author)
W86-02320

WET METHOD FOR EXCRETA DISPOSAL,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02333

LOW-COST ALTERNATIVES TO SEWERAGE,
Cole and Co. Ltd., Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W86-02334

EXCRETA REUSE OPTIONS: COMPOSTING AND BIOGAS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-02335

OXIDATION PONDS AND FISH CULTURE,
Cole and Co. Ltd., Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W86-02336

SANITATION ASPECTS OF WATER SUPPLY AND EXCRETA DISPOSAL,
Ministry of Health, Lilongwe (Malawi).
W. G. Bomba.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 311-325, 5 fig, 2 tab, 9 ref.

Descriptors: *Sanitation, *Public health, *Waste disposal, *Water supply, *Developing countries, Water quality, Drinking water, Case studies, Water supply development, Water quality control, Water quality management, Pathogens, Infection, Human diseases, Social aspects.

The improvement of public health in developing countries can only arise through satisfactory systems of water supply, sanitation and health education. The role of health education in sanitation programs is highlighted using two case studies - a water study in Lesotho and latrinization program in Malawi. The principal human diseases that can be transmitted by water and their causative agents (bacteria, protozoa, viruses, and helminths) are reviewed. Many water-related diseases have more than one route of transmission. The ingestion of food or drink contaminated with feces, infection from contact with water, transmission from contact with soil, infection via insect vectors, and infection via meat are considered. Education programs had to be adopted in Malawi to encourage people to use latrines. Water contamination may take place when water is drawn from unprotected

sources, when drawn from taps into contaminated containers, or when storage containers inside the home are left uncovered. Coliform bacteria is usually used as an indicator of drinking water quality. The decision to condemn a certain water supply should be left to those who know the local circumstances and who are responsible for safeguarding the health of the community. (Geiger-PTT)
W86-02340

5F. Water Treatment and Quality Alteration

ZETA POTENTIAL STUDY OF THE WATER TREATMENT OF GEOTHERMAL BRINES,
Idaho National Engineering Lab., Idaho Falls.
P. M. Wikoff, and D. F. Suciu.
Available from the National Technical Information Service, Springfield, VA 22161 as DE-005910, Price codes: A03 in paper copy, A01 in microfiche. Report EGG-GTH-5673, November 1981. 27 p, 15 fig, 3 tab, 7 ref. DE-AC07-761D01570.

Descriptors: *Water treatment, *Cooling water, *Flocculation, Corrosion control, Geothermal studies, Zeta potential, Silica, Phosphates, Ferrous sulfate, Polymers, Adsorption, Magnesium oxide, Lime, Brines.

Zeta potential studies on geothermal cooling water were performed on the silica reduction system and the phosphate reduction system. In the silica reduction system, data suggested that adsorption occurred between the magnesium hydroxide formed in solution and the silica. Addition of calcium ion caused a bridging type of adsorption between the silica-magnesium hydroxide particles. The optimum magnesium oxide concentration, added as magnesium chloride, was 150-200 ppm MgO. Optimum pH, adjusted with lime, was 10.2. The best polymer was Betz 1125L at a dose of 1 ppm. An excess of polymer (8 ppm or greater) left more silica in solution. In the phosphate reduction system the optimum iron concentration was 20-30 ppm added as ferrous sulfate. Optimum pH, adjusted with lime, was 9.2 Betz 1195, a cationic polymer, produced the largest, best-selling flocs at an optimum concentration of 2-4 ppm. Since the phosphate studies were done on domestic water, further research is needed to account for the zinc sulfate or dispersants normally present in blowdown water. (Cassar-PTT)
W86-01987

RATIONAL PROCEDURE FOR ESTABLISHING DISCHARGE CONCENTRATION LIMITS IN MUNICIPAL SEWER USE ORDINANCES,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
For primary bibliographic entry see Field 5D.
W86-02103

TREATMENT ALTERNATIVES FOR GROUNDWATER CONTAMINATION,
Montgomery (James M.), Inc., Reston, VA.
A. R. Appleton, and M. Kavannaugh.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 351-383, 6 fig, 10 tab, 33 ref.

Descriptors: *Aeration, *Groundwater pollution, *Activated carbon, *Design criteria, *Case studies, Water treatment, Adsorption, Organic compounds, Water quality control, Odor, Taste, Water pollution sources, Cost analysis.

Several options are available for the removal or reduction of carcinogenic compounds from groundwater. These include: source control, blending with uncontaminated sources, development of new sources, treatment of contaminated sources, and point-of-use treatment. Physicochemical parameters of organic compounds are useful in predicting their behavior in the environment and removal efficiencies in treatment processes. Aeration processes, particularly packed tower air stripping, may be effective in treating contaminated groundwaters. Similarly, the octanol:water partition coefficient is useful in predicting the effectiveness of granular activated carbon adsorption for removal of specific compounds. More accurate cost estimates for CAC adsorption, as well as aeration, require full-scale design criteria obtained through site specific pilot-scale studies. Two case studies from Southern California are presented to illustrate full-scale applications of treatment processes for the removal of organic compounds from groundwaters. The Valley County Water District used an air stripping system for the removal of trichloroethane and the City of La Habra used a packed tower to alleviate taste and odor problems. (Geiger-PTT)
W86-02110

WATER CHLORINATION: ENVIRONMENTAL IMPACT AND HEALTH EFFECTS; VOLUME 4, BOOK 1: CHEMISTRY AND WATER TREATMENT,
Proceedings of the Fourth Conference on Water Chlorination: Environmental Impact and Health Effects, Pacific Grove, California, October 18-23, 1981. Ann Arbor Science, Ann Arbor, MI. 1983. 2 v. (1491 p.) Edited by Robert L. Jolley, Wiliam A. Brungs, Joseph A. Cotruvo, Robert B. Cumming, and Jack S. Mattice.

Descriptors: Fate of pollutants, *Water treatment, *Chlorination, *Pollutant identification, *Water analysis, Chloramines, Bromination, Organic compounds, Trihalomethanes, Chlorinated hydrocarbons, Chlorine demand, Residual chlorine, Wastewater treatment, Wastewater analysis, Kinetics, Chemical reactions, Activated carbon, Humic acids, Fulvic acids, Oxidation, Organic matter, Cooling water, Seawater, Disinfection, Chromatography, Trace levels.

This volume concerns the chemistry of water treatment, emphasizing the fate and effects of chlorine. Section I describes the chemistry of nitrogenous and other compounds, including the products of halogens with ammonia, amino acids, proteins, polynuclear aromatic hydrocarbons, and lipids. Section II, the chemistry of chlorine demand, considers the products formed when chlorine and bromine react with aquatic humic materials and other organic matter to form trihalomethanes and other halogenated compounds. Section III discusses the fate of chlorine and the formation of halogenated organic compounds in cooling water, drinking water, wastewater, and municipal landfill leachates. The alternative disinfectants, hydrogen peroxide and ozone, are evaluated. Analytical methods are presented in Section IV and V. They include methods for analyzing halogenated organic mixtures as well as for determing chloramines, residual chlorine, and residual oxidants attrace levels. Several systems for continuous monitoring are described. (Cassar-PTT)
W86-02135

REVIEW OF THE CHEMISTRY AND ENVIRONMENTAL FATE OF REACTIVE OXIDANT SPECIES IN CHLORINATED WATER,
Oak Ridge National Lab., TN.
R. L. Jolley, and J. H. Carpenter.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 3-47, 4 fig, 7 tab, 118 ref. EPA079-D-X0789.

Descriptors: *Water treatment, *Literature reviews, *Chlorination, *Bromination, *Oxidation, Chemical reactions, Organic compounds, Chloramines, Bromamines, Trihalomethanes, Wastewater treatment, Hypochlorous acid, Hypobromous acid, Iodine, Chlorine demand, Fate of pollutants, Ammonia, Nitrogen compounds.

This review concerns the chemistry of chlorine in wastewaters and in natural waters as it pertains to the formation, degradation, and reaction products of free and combined oxidants. Chlorine hydrolyzes very rapidly in water to form hypochlorous acid, which upon dissociation forms hypochlorite ion. As pH increases, the hypochlorite ion becomes more dominant than the undissociated acid. Chlorine added to water containing bromide yields hypobromous acid and chloride ion. Dissociation of hypobromous acid forms hypobromite ion, which is dominant at higher pH. Chlorination of iodine-containing water produces molecular iodine and chloride. Ammonia combines with hypohalous acids to form mono- and dihalamines as well as nitrogen tribromide and trichloride. Monochloramine and dibromamine are common constituents of chlorinated and brominated wastewaters. Although monochloramine is a less effective chlorinating agent than hypochlorous acid, it minimizes formation of trihalomethanes during water treatment. Chlorine or bromine plus amino acids or other nitrogen-containing organics yields organic chloramines or bromamines. Knowledge of the organic halamines and their reaction products in natural water is limited. Bromochloramines can form in salt water systems. Chlorine demand, the difference between chlorine dosage applied to water and the measured available chlorine, is a result of inorganic oxidation and reactions with organic matter. Disproportionation of hypohalous acids (e.g., formation of chlorate and chloride) takes place at basic pH. Photochemical or catalytic influence cause hypohalous acids to decompose yielding oxygen. Free available chlorine also reacts with organic matter to form a complex mixture of organohalides. (Cassar-PTT)
W86-02136

MODELING OF REACTIONS BETWEEN AQUEOUS CHLORINE AND NITROGENOUS COMPOUNDS,
Massachusetts Dept. of Environmental Quality Engineering, Westborough. Div. of Water Pollution Control.
For primary bibliographic entry see Field 5D.
W86-02137

CRITICAL REVIEW OF KINETIC AND THERMODYNAMIC CONSTANTS FOR THE AQUEOUS CHLORINE-AMMONIA SYSTEM,
Harvard Univ., Cambridge, MA. Dept. of Applied Science.
J. C. Morris, and R. A. Isaac.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 49-62, 4 fig. 2 tab, 19 ref. DAMD 17-77-C-7051.

Descriptors: *Water treatment, *Chlorination, *Chemical reactions, *Nitrogen compounds, Chloramines, Hydrolysis, Kinetics, Thermodynamics.

Tables list a complete summary of the kinetic and equilibrium constants and the derived thermodynamic quantities for reactions of the aqueous chlorine-ammonia system. Reaction systems considered are (1) monochloramine + water yield ammonia + hypochlorous acid, (2) dichloramine + water yield monochloramine + hypochlorous acid, (3) nitrogren trichloride + water yield dichloramine + hypochlorous acid, and (4) disproportionation of monochloramine to yield ammonia and dichloramine. Some of the values are less accurate than desired; some are based on relatively insecure assumptions. However, trends are seen in reactivity, degree of phydrolysis, and endothermicity. (Cassar-PTT)
W86-02138

ULTRAVIOLET ABSORPTION SPECTRA OF BROMOCHLORAMINE AND DIBROMOCHLORAMINE IN ETHER,
Tennessee Univ., Knoxville. Dept. of Chemistry.
W. R. Haag, and R. L. Jolley.
IN: Water Chlorination: Environmental Impact and Health Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983, p 77-83, 2 fig, 10 ref.

Descriptors: *Water treatment, *Chlorination, Chloramines, Bromochloramines, Spectrometry.

Ultraviolet absorption spectra were determined for bromochloramine and dibromochloramine in ether. These compounds were prepared by mixing hypobromite solution with monochloramine. At a HOBr/NH2C1 molar ratio <0.4 two new peaks at 220 and 333 nm were always observed on top of

the monochloramine spectrum, and the increase in absorbance between successive experiments was proportional to the difference in the amount of bromine added, suggesting that a single new compound (NHBrC1) had been formed. Increasing the HOBr/NH2C1 molar ratio above 0.5 produced spectra which indicated the formation of NBr2C1. Based on the ether spectra, the NBrC12 peak in water, at 230 nm with maximum extinction coefficient of about 7000. Possible reasons that these compounds have not been detected in chlorinated saline water are (1) overlapping absorption bands caused by mixtures of halamines and (2) rapid decomposition of the bromochloramines. (Cassar-PTT)
W86-02139

DIHALOACETONITRILES IN CHLORINATED NATURAL WATERS,
Florida Atlantic Univ., Boca Raton. Dept. of Chemistry.
. I. Bieber, and M. L. Trehy.
N: Water Chlorination: Environmental Impact nd Health Effects; Volume 4, Book 1: Chemistry ed Water Treatment, Ann Arbor Science, Ann rbor, MI. 1983. p 85-96, 3 tab, 30 ref.

escriptors: *Water treatment, *Chlorination, Dihloacetonitriles, Chlorinated hydrocarbons, Nitrogen compounds, Amino acids, Dichloroacetonitrile, Dibromoacetonitrile, Proteins, Trihalomethanes, Activated carbon, Absorption, Chloramine.

ichloroacetonitrile, dibromoacetonitrile, and bromochloroacetonitrile were identified in chlorinated tural waters in south Floriday. Thes result from lorination of proteinaceous materials such as certain amino acids and polypeptides. Aspartic acid d aspartyl residues are especially prolific dihacetonitrile (DHAN) producers. Chlorination of e water at 6 and 20 mg/liter chlorine for 15 min owed that increasing concentrations of DHANs re formed with increasing contact time. Levels DHANs were also higher at the 20 mg/liter el. For example, at 20 mg/liter and 15 min ntact time concentrations in ppb were as follvs: dichloroacetonitrile, 5.2, and bromochloroonitrile, 0.4. Likewise, the concentrations of alomethanes (THMs) increased with dose and ntact time. Levels of total THMs produced in e water samples at 20 mg/liter chlorine and 15 contact time were 182 ppb. Activated carbon be used to remove DHAN precursors, but the cess is energy-intensive, costly, and has many iables. Lime treatment increases water pH, rtens the half-lives of the DHANs, but inases the levels of THMs formed. Use of chlorne as a disinfectant maintains low levels of AN. (Cassar-PTT)
6-02140

ODUCT DISTRIBUTION AND RELATIVE TES OF REACTION OF AQUEOUS CHLOE AND CHLORINE DIOXIDE WITH PONUCLEAR AROMATIC HYDROCARBONS,
nesota Univ.-Duluth. Dept. of Chemistry.
primary bibliographic entry see Field 5B.
5-02145

LORINE DEMAND: STUDIES CONCERN- ITS CHEMICAL BASIS,
yland Univ., College Park. Dept. of Chemis-

. Helz, D. A. Dotson, and A. C. Sigleo.
Water Chlorination: Environmental Impact Health Effects; Volume 4, Book 1: Chemistry Water Treatment, Ann Arbor Science, Ann or, MI. 1983, p 181-190, 2 fig, 2 tab, 15 ref.

criptors: Fate of pollutants, *Water treatment, orination, *Organic matter, *Oxidation, Pro, Amino acids, Chlorine demand, *Wastewater ment, Waste treatment.

oxidizing agents assayed by standard chlorine ses are known to disappear on time scales ng from minutes to days, depending on treat- conditions and water quality but the reacresponsible for this disappearance are poorly n. An assortment of evidence points to reactions involving organic matter as major chlorine consumers, but it is generally agreed that formation of halocarbons is minor. Experiments in which river water was treated with about 150 microM of NaOC1 (about 10 ppm C12) produced about 35 microM of carbon dioxide. However, oxidation of organic matter to carbon dioxide in these experiments definitely cannot account for all the chlorine decay and probably accounts for only about half of it. Investigation of the effect of chlorination on protein macromolecules showed a general loss of protein amino acids after chlorination, as well as a more pronounced loss of the specific amino acids that possess reactive side groups (lysine, histidine, arginine, methionine, and tyrosine). Because only two reaction products were observed during amino acid analysis by liquid chromatography and gas chromatography, it is concluded that most off the reactive amino acids are substantially altered or totally oxidized by chlorination. The general loss of protein could be caused by scission of the protein chain at sites occupied by reactive amino acids, yielding polymer fragments too small in some cases to be recovered by ultrafiltration. (Author)
W86-02147

CHLORINATION PRODUCTS FROM AQUATIC HUMIC MATERIAL AT NEUTRAL PH,
North Carolina Univ. at Chapel Hill. School of Public Health.
For primary bibliographic entry see Field 5B.
W86-02148

FULVIC ACID AND CHLORINATED FULVIC ACID IN WATER AND SEDIMENT: HPLC FRACTIONATION AND SPECTROSCOPIC CHARACTERIZATION,
North Texas State Univ., Denton. Inst. of Applied Sciences.
For primary bibliographic entry see Field 5B.
W86-02149

ORGANIC REACTION PRODUCTS OF CHLORINE DIOXIDE AND NATURAL AQUATIC FULVIC ACIDS,
North Carolina Univ. at Chapel Hill. School of Public Health.
For primary bibliographic entry see Field 5B.
W86-02150

INFLUENCE OF AQUATIC HUMIC SUBSTANCE PROPERTIES ON TRIHALOMETHANE POTENTIAL,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W86-02151

EMPIRICAL MODEL FOR PREDICTING CHLOROFORM FORMATION FROM HUMIC AND FULVIC ACIDS,
For primary bibliographic entry see Field 5B.
W86-02152

FORMATION OF TRIHALOMETHANES FROM THE HALOGENATION OF 1,3-DIHYDROXYBENZENES IN DILUTE AQUEOUS SOLUTION: SYNTHESIS OF 2-13 C-RESORCINOL AND ITS REACTION WITH CHLORINE AND BROMINE,
California Inst. of Tech., Pasadena. Dept. of Environmental Engineering Science.
For primary bibliographic entry see Field 5B.
W86-02153

KINETICS AND MECHANISM OF HALOFORM FORMATION: CHLOROFORM FORMATION FROM TRICHLOROACETONE,
Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
For primary bibliographic entry see Field 5B.
W86-02154

QUANTITATIVE EFFECTS OF BROMINE ON THE FORMATION AND DISTRIBUTION OF TRIHALOMETHANES IN GROUNDWATER WITH A HIGH ORGANIC CONTENT,
Florida International Univ., Miami. Drinking Water Quality Research Center.
For primary bibliographic entry see Field 5B.
W86-02155

FORMATION OF BROMINATED TRIHALOMETHANES: EXTENT AND KINETICS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-02156

BROMOFORM PRODUCTION IN TROPICAL OPEN-OCEAN WATERS: OCEAN THERMAL ENERGY CONVERSION CHLORINATION,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 5B.
W86-02157

DISPERSION OF CHLORINE AT SEVEN SOUTHERN CALIFORNIA COASTAL GENERATING STATIONS,
Southern California Edison Co., Rosemead.
For primary bibliographic entry see Field 5B.
W86-02158

MODEL FOR PREDICTING CHLORINE CONCENTRATION WITHIN MARINE COOLING CIRCUITS AND ITS DISSIPATION AT OUTFALLS,
Central Electricity Generating Board, Fawley (England). Marine Biological Unit.
For primary bibliographic entry see Field 5B.
W86-02159

HALOGENATED ORGANIC STUDY AT SELECTED TENNESSEE VALLEY AUTHORITY FOSSIL-FUELED POWER PLANTS,
Tennessee Valley Authority, Chattanooga.
For primary bibliographic entry see Field 5B.
W86-02161

ORGANOHALOGENS IN CHLORINATED COOLING WATERS DISCHARGED FROM NUCLEAR POWER STATIONS,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W86-02162

ATMOSPHERIC EMISSIONS FROM ELECTRIC POWER PLANT COOLING SYSTEMS,
SRI International, Menlo Park, CA.
For primary bibliographic entry see Field 5B.
W86-02163

HYDROGEN PEROXIDE - A REAL ALTERNATIVE TO CHLORINE IN WATER TREATMENT,
North Surrey Water Co., Staines (England).
For primary bibliographic entry see Field 5B.
W86-02164

EVALUATION OF OZONE PRETREATMENT OF SURFACE WATERS PRIOR TO CHLORINATION FOR REDUCTION IN TRIHALOMETHANE FORMATION,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
J. N. Veenstra, J. B. Barber, and P. A. Khan.
IN: Water Chlorination: Environmental Impact and Helath Effects; Volume 4, Book 1: Chemistry and Water Treatment, Ann Arbor Science, Ann Arbor, MI. 1983. p 455-465, 7 fig, 1 tab, 10 ref.

Descriptors: *Water treatment, *Ozonation, Chlorination, Trihalomethanes, Organic carbon, Chlorinated hydrocarbons, Kaw Lake, Oklahoma, Disinfection.

Ozone pretreatment of Kaw Lake (Oklahoma) water before chlorination affected reductions in

the total organic carbon (TOC) and trihalomethane(THM)-forming potential. With mean absorbed ozone dosage of 2.9 +- 1.1 mg/liter (+-1 SD), the mean TOC reduction was 10.3 + 23.0% (+-1 SD). The TOC chromatgrams for all samples showed the predominance of one peak for the TOC in the molecular weight fraction of 1000 to 5000. Seasonal shifts in TOC patterns occurred as illustrated by the change in percentage of TOC in the <4000 apparent molecular weight group was found in the ozonated samples than in the raw water samples. This difference, which varied from 5 to 8%, reflected the effect of ozonation. A seasonal shift toward bromoform in the total trihalomethane production was observed, and ozonation accentuated the shift toward bromoform. Ozonation caused a decrease in the yields of allfour trihalomethanes. For Kaw Lake, water ozonation caused a greater reduction in total trihalomethanes than in TOC. Possible alteration of the precursors by ozonation could make them less amendable to trihalomethane formation. Preliminary results of this study have shown preozonation to have a limited effect in reducing the concentration of the more brominated trihalomethanes. The study is continuing because the potential overall effects of preozonation have not been fully evaluated. (Author)
W86-02167

INFLUENCE OF PRECHLORINATION ON THE AMOUNT AND TOXICITY OF MICROPOLLUTANTS EXTRACTED FROM WATER AT THE MORSANG PLANT,
Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).
For primary bibliographic entry see Field 5B.
W86-02168

WATER TREATMENT PLANT DESIGN FOR THE PRACTICING ENGINEER.
Ann Arbor Science, Ann Arbor, MI. 1982. Edited by Robert L. Sanks. 845 p.

Descriptors: *Water treatment, *Water treatment facilities, *Chemical treatment, Drinking water, Potable water, Coagulation, Flocculation, Filtration, Sedimentation, Water analysis.

Various aspects of water treatment plant design are presented to assist consulting engineers. Specific areas of discussion include effects of federal regulations on water treatment design, public health aspects of water supplies, treatment processes (coagulation, sedimentation, flocculation, filtration, suspended solids removal, softening, ion exchange, sludge removal), chemical handling and feeding, equipment design, package water treatment plants, corrosion control, automated operation, pump station design, instrumentation, cost estimation techniques, operation and maintenance manuals, and operator training. (Halterman-PTT)
W86-02188

EFFECTS OF FEDERAL REGULATIONS ON WATER TREATMENT PLANT DESIGN,
Environmental Protection Agency, Denver, CO. Region VIII.
P. E. Hoffbuhr, and D. R. Chaussee.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 1-15, 8 tab, 8 ref.

Descriptors: *Water treatment, *Chemical treatment, Water treatment facilities, Legal aspects, Regulations, Drinking water, Potable water.

Various aspects of the Safe Drinking Water Act are discussed, with emphasis on maximum contaminant levels, and design consideration, including water source treatment selection. The focus of the treatment selection discussion is inorganic and organic chemical removal, turbidity, microbiological contaminants and radiological chemicals. The greatest difficulty will be for small communities to meet the requirements of the new law. Since cost effective water treatment processes for small water systems have never been fully developed, research in this area is badly needed. (Halterman-PTT)
W86-02189

PUBLIC HEALTH ASPECTS OF WATER SUPPLIES,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5C.
W86-02190

PREDESIGN STUDIES,
Montgomery (James M.), Inc., Pasadena, CA.
R. R. Trussell.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 37-64, 13 fig, 4 tab, 36 ref.

Descriptors: *Water treatment, *Drinking water, Potable water, Water analysis, Treated water, Filtration, Flocculation, Water treatment facilities, Turbidity.

Methods for establishing treatment requirements for specific water supplies, prior to the designing of a treatment plant, are detailed. The treatment processes of major concern are removal of turbidity, iron, manganese, color and H2S; treatment for tastes and odors; softening; and disinfection. To assist the design engineer, applicable water quality standards and their meaning are discussed. Methods for evaluating water sources are reviewed, with special emphasis on meaningful methods of data analysis. Appropriate bench-scale tests are discussed, emphasizing evaluation of jar test data (turbidity topogram) and direct filtration studies. Pilot studies are discussed in detail, including comments on flocculation, sedimentation and filtration. (Halterman-PTT)
W86-02191

COAGULATION,
North Carolina Univ. at Charlotte. Dept. of Environmental Sciences and Engineering.
C. R. O'Melia.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 65-81, 4 fig, 19 ref.

Descriptors: *Water treatment, *Coagulation, Flocculation, Water treatment facilities, Aluminum sulfate, Color removal, Turbidity, Pollutants.

Coagulation, the process for combining small particles into larger aggregates, is an essential component of accepted water treatment practice in which coagulation, sedimentation and filtration processes are combined in a series to remove particulates from water. The coagulation process, including destabilization and mixing, is outlined. The materials used for destabilization are described. They include hydrolyzing metal ions (primarily aluminum), synthetic polymers, and coagulant aids (such as activated silic). Some guidelines for proper selection of these materials are provided. Finally, rapid mix and flocculation tanks are discussed. Guidelines for their proper use are provided. (Halterman-PTT)
W86-02192

SLUDGE DISPOSAL AND THE A.P. BLACK PROCESS,
Gainesville-Alachua County Regional Electric Water and Sewer Utilities Board, FL.
A. T. DuBose.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 83-103, 2 fig, 6 tab, 10 ref.

Descriptors: *Water treatment, *Chemical treatment, *Sludge utilization, Water treatment facilities, Turbidity, Flocculation, Water analysis, Sludge disposal, Sludge thickening.

The A.P. Black process for sludge removal entails pumping thickened sludge, produced from the lime-softening of hard, turbid or colored water, to a series of sludge carbonation cells where it is mixed with scrubbed kiln gas containing 20% CO2. The magnesium hydroxide is dissolved from calcium carbonate and turbidity factors. This slurry passes to a thickener from which clear supernatant containing soluble magnesium bicarbonate overflows and passes to a heat exchange unit and is warmed to 40 degrees C. After stirring, th precipitation of magnesium carbonate as the trih drate is rapid and complete in 90 seconds. Th turbidity factors are then removed by froth flot tion, and the purified CaCO3 is calcinated to high quality quicklime. The economics of th process are discussed and the application of th method under varying conditions is describe (Halterman-PTT)
W86-02193

FLOTATION PROCESS USED FOR CALCIU CARBONATE RECOVERY FROM WATE TREATMENT SLUDGES,
Dawson Metallurgical Labs., Inc., Murray, U
H. A. Dawson.
IN: Water Treatment Plant Design for the Practi ing Engineer, Ann Arbor Science, Ann Arbor, M 1982. p 105-124, 6 fig, 6 tab, 9 ref.

Descriptors: *Water treatment, *Chemical trea ment, *Froth flotation, Flotation, Treated wate Flocculation, Turbidity, Coagulation, Chemic coagulation, Calcium carbonate.

Froth flotation is a physico-chemical method f separating types of minerals or compounds prese as discrete particles in an aqueous slurry. T history, mechanics of action, and the process a described. Results from tests conducted at sever plants indicate that this process is relatively simpl easily controlled, and practical for the recovery magnesium carbonate in large water treatme plants. The magnesium carbonate process is app cable for coagulation in the smallest plants. T recovery of magnesium carbonate, howeve should be limited to plants that require at lest 0 ton of coagulant per day. (Halterman-PTT)
W86-02194

DESIGN OF RAPID MIX UNITS,
Montana State Univ., Bozeman. Dept. of Ci Engineering and Engineering Mechanics.
A. Amirtharajah.
IN: Water Treatment Plant Design for the Practi ing Engineer, Ann Arbor Science, Ann Arbor, M 1982. p 131-147, 3 fig, 3 tab, 23 ref.

Descriptors: *Water treatment, *Chemical tre ment, Flocculation, Treated water, Turbidity, C agulation, Aluminum sulfate, Alum.

The rapid mix unit is often the first step in a wa treatment process train, and provides the hardwa necessary for the initial stages of the coagulati process. Some theoretical considerations for t rapid mixing operation are outlined, and summar of the available alternatives in design are prese ed. Data needed for optimal design include analy of best and worst raw water conditions, minimu and maximum flow rates, and typical jar test r sults of all water samples. The location of the ra mix units must be close to the coagulant feed tar to minimize clogging. Furthermore, the alum so tion lines should be able to feed 5% or less into t raw water. (Halterman-PTT)
W86-02195

SEDIMENTATION,
Walker Engineer, Aurora, IL.
J. D. Walker.
IN: Water Treatment Plant Design for the Pract ing Engineer, Ann Arbor Science, Ann Arbor, M 1982. p 149--182, 9 fig, 4 tab, 8 ref.

Descriptors: *Water treatment, *Chemical tre ment, Flocculation, Treated water, Turbidity, C agulation, Aluminum sulfate, Alum, Slud Sludge disposal.

Sedimentation of flocculent solids to produce clear effluent can be accomplished in several wa The most economical and easily operated unit this process is a well-designed clarifier bas equipped with a sludge scraper and underfl control system. Solids contact systems, with combination of solids return, high-rate mixing, f aggregation, and circumferential vertical rise cl fication, are also important considerations. Fl preparation before sedimentation should consist

nstant blending, rapid mixing floc aggregation. The newer high-rate settlers such as inclined tube r plate modules also warrant consideration, espeially for small flows. Furthermore, conservative urface-loading rate parameters work well for mall flow systems. (Halterman-PTT)
V86-02196

LUDGE DISPOSAL,
lvord, Burdick and Howson, Chicago, IL.
. R. Howson.
N: Water Treatment Plant Design for the Practicg Engineer, Ann Arbor Science, Ann Arbor, MI, 982. p 183-193, 2 fig, 8 ref.

escriptors: *Sludge, *Sludge disposal, *Water eatment, *Sludge lagoons, Flocculation, Coagution, Aluminum sulfate, Alum, Sludge thickeng, Sludge solids.

Vaterworks sludge is the suspended solid material and, silt, clay and algae) present in raw water us the precipitated chemicals added to facilitate paration of suspended solids. Sludge is usually moved by a variety of methods, including backashing, followed by deposition in lagoons. The e of lagoons is the most economical means of udge removal, especially in small treatment ants. The costs of such methods as pressing and ntrifugation usually exceeds the costs of lagoons. lalterman-PTT)
86-02197

ESIGN OF FLOCCULATION SYSTEMS,
ontana State Univ., Bozeman. Dept. of Civil ngineering and Engineering Mechanics.
Amirtharajah.
: Water Treatment Plant Design for the Practic Engineer, Ann Arbor Science, Ann Arbor, MI, 82. p 195-229, 8 fig, 3 tab, 38 ref.

scriptors: *Water treatment, Flocculation, emical treatment, Turbidity, Chemical coagulan, Treated water, Aluminum sulfate, Clarifiers, tration.

e flocculation stage in water treatment is the gregation or growth of the destabilized colloidal pension. Two major mechanisms are identified: ikinesis (aggregation resulting from random rmal motion and significant for particles less n 2 microns); and orthokinesis (induced by veity gradients in the fluid). The available kinetic dels of the flocculation process are described, the design of mechanical flocculators and lge blanket clarifiers are discussed. (Halterman-T)
6-02198

ANULAR-MEDIA DEEP-BED FILTRATION,
va State Univ., Ames. Dept. of Civil Engineer-

R. Baumann.
Water Treatment Plant Design for the Practic-Engineer, Ann Arbor Science, Ann Arbor, MI, 2. p 231-281, 25 fig, 6 tab, 42 ref.

criptors: *Water treatment, *Filtration, Drinkwater, Potable water, Trace metals, Bacterial ysis, Metals, Treated water.

p-bed granular-media filters find widespread in potable water treatment for the removal of ended solids in a variety of applications, inding iron and manganese precipitates removed n ground water supplies; removal of softening ipitate carry-over from lime-soda ash softening round or surface water supplies; removal of carry-over resulting from coagulation-flocculn-sedimentation of surface waters; and removf microorganisms. Currently accepted technolthe hudraulics of flow in filters, filtered water ity considerations, filter control methods, and media are discussed in detail. (Halterman-)
-02199

PENDED SOLIDS REMOVAL,
nutit Co., Inc., Paramus, NJ.
R. T. O'Connell.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 283-298, 4 fig, 1 tab, 9 ref.

Descriptors: *Water treatment, *Suspended solids, Flocculation, Chemical treatment, Turbidity, Chemical coagulation, Treated water, Aluminum sulfate, Clarifiers, Filtration.

Ideally, a water treatment plant effluent should contain less than one turbidity unit. To attain this quality, a water treatment plant must be equipped with the proper unit process to remove suspended solids. The various compounds used for chemical coagulation are reviewed. Alum is the most widely used material. Ferrous sulfate and ferric sulfate are commonly used when a wide range of pH exists. The use of Bentonite clay, powdered activated carbon and polymers for aiding coagulation are described. Solids contact-sludge blanket units and filtration are also discussed. The estimated costs for capital equipment, including solids contact units, gravity filters, chemical feeds and controls are provided. (Halterman-PTT)
W86-02200

ADVANCED TECHNIQUES FOR SUSPENDED SOLIDS REMOVAL,
Neptune Microfloc, Inc., Corvallis, OR.
W. R. Conley, and S. P. Hansen.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 299-312, 9 fig, 2 tab, 10 ref.

Descriptors: *Water treatment, *Suspended solids, Flocculation, Chemical treatment, Turbidity, Chemical coagulation, Treated water, Aluminum sulfate, Clarifiers, Filtration.

Improved suspended solids removal, at a low cost, can best be achieved by precisely controlling coagulation. Advanced technology for doing so includes the use of a coagulant control center which continuously monitors coagulation conditions and alerts the operator to any changes. High-rate treatments (tube settlers, and mixed media filters) also help improve the system by reducing costs. The combination of these two modifications provides superior suspended solids removal at capitol costs lower than those of conventional water treatment plants. (Halterman-PTT)
W86-02201

PRECOAT FILTRATION,
Iowa State Univ., Ames. Dept. of Civil Engineering.
E. R. Baumann.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 313-370, 34 fig, 11 tab, 18 ref.

Descriptors: *Water treatment, *Suspended solids, Flocculation, Chemical treatment, Turbidity, Chemical coagulation, Treated water, Aluminum sulfate, Clarifiers, Filtration.

Precoat filtration, employing thin layer (3-5 mm) of filter media, requires three steps: a precoating operation, a filtering step, and a backwashing operation. This effective filtering procedure results in the loss of filter media after each run because it is quite difficult to separate the filter media from the solids that were removed. The entire operation is described, along with guidelines for selection of filter types, filter media, and filter media coatings. Various applications for precoat filtering are provided, including budgetary constraints, large seasonal variation in demand, and systems needing emergency or standby service. Optimal plant designs for precoat filtering are discussed. (Halterman-PTT)
W86-02202

DESIGN AND APPLICATION OF POTABLE WATER CHLORINATION SYSTEMS,
G. C. White.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 371-395, 1 fig, 10 ref.

Descriptors: *Water treatment, *Drinking water, *Chlorination, *Chlorine, Potable water, Bacterial analysis, Wastewater treatment, Residual chlorine.

The information necessary for the design of a chlorination system is provided, and the objectives of chlorination and its many uses in water treatment are outlined, and the means of achieving these objectives are discussed. Chlorination has historically been a method of choice for disinfection, taste and odor control, algal growth prevention, slime prevention, removal of iron and manganese, and organic color bleaching. The benefits of chlorination with hypochlorinators and gas chlorinators are compared. Injector systems, diffusers, mixing devices and safety equipment are discussed. (Halterman-PTT)
W86-02203

PUMP STATIONS,
Black and Veatch, Kansas City, MO.
J. R. Wright.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 397-414, 7 fig, 1 tab, 2 ref.

Descriptors: *Water treatment, *Water treatment facilities, *Pumping, Pumping plants, Pumping tests, Pumps, Drinking water, Potable water.

Since water must be pumped either from the source of supply to the treatment works, or from the treatment works into the delivery system, or both, the pumping facilities must be consistent with the treatment plant design concepts. General considerations to be made are structural, architectural, and the layout of the equipment. Pump selection is based on a variety of factors, including pump design, pump control systems, drive systems (gasoline, gas, diesel, electric), cavitation tendency, sump design, piping, and valves. The important specification criteria for pumping stations and some data on costs of pumping stations are provided. (Halterman-PTT)
W86-02204

PACKAGE WATER TREATMENT PLANTS,
Culp/Wesner/Culp, Shingle Springs, CA.
S. P. Hansen, and W. R. Conley.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 415-434, 7 fig, 4 tab, 6 ref.

Descriptors: *Water treatment, *Drinking water, *Water treatment facilities, Potable water, Coagulation, Flocculation, Filtration, Settling tanks, Sedimentation.

The package water treatment plant has become established as a practical and economic solution for providing treated water for small communities. The historical problems associated with these systems have been overcome with recent developments in flocculation, clarification, and filtration. Features that are available to continuously monitor filtered water turbidity and to prevent the introduction of poor quality water into the distribution system are discussed. Because of the economics of their construction, ease of operation and maintenance, and reliability, package plants should be carefully considered for flows of less than 5 mgd. (Halterman-PTT)
W86-02205

PACKAGE WATER TREATMENT EQUIPMENT,
Permutit Co., Inc., Paramus, NJ.
R. T. O'Connell.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 435-445, 5 fig, 2 tab.

Descriptors: *Water treatment, *Drinking water, *Water treatment facilities, Potable water, Coagultion, Flocculation, Filtration, Settling tanks, Sedimentation.

Package-type water treatment equipment (preassembled, modular treatment units) for removal of suspended solids are discussed, and examples of

treatment systems are detailed. The sludge blanket clarifiers, with horizontally mounted agitators, are well suited for the package-type unit concept because they are small, the internal parts can be readily fabricated, and the units require no welding. Steel-shell cylindrical gravity filters can be shipped partially preassembled. The two major types in use are the automatic valveless gravity filter and the steel shell, conventional style gravity filters. Two examples of system development are diagramed, showing raw water intake, chemical dosing for coagulation, agitation, and sludge filtration. Differences in the systems, with regard to filtration, are discussed. (Halterman-PTT)
W86-02206

INSTRUMENTATION FOR AUTOMATIC OPERATION,
R. H. Babcock.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 447-459, 2 fig, 3 tab, 9 ref.

Descriptors: *Water treatment, *Chemical treatment, *Water treatment facilities, Drinking water, Potablewater, Water analysis, Turbidity, Pollutants, Hydrogen ion concentration, Residual chlorine.

Automatic treatment systems have instrumentation that must control critical tasks, minimize tedious repetitive tasks, and provide a tool for process supervision. Critical areas are measurement of flow and level; analytical measurement and control (pH, turbidity, chlorine residual, fluoride and hardness); alarm systems; and the modulation of controls. The automatic control of treatment systems is becoming a major factor in the design of modern systems. (Halterman-PTT)
W86-02207

POTASSIUM PERMANGANATE FOR IRON AND MANGANESE REMOVAL AND TASTE AND ODOR CONTROL,
Carus Chemical Co., La Salle, IL.
K. J. Ficek.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 461-479, 10 fig, 2 tab, 20 ref.

Descriptors: *Water treatment, *Chemical treatment, *Drinking water, Potable water, Taste, Odor Control, Odors, Potassium permanganate, Chlorine.

Potassium permanganate can be used effectively and economically to reduce taste and odors and to oxidize iron and manganese. Because it is an oxidizing agent, potassium permanganate application prior to chlorination reduces the chlorine requirement. It can be used with other water treatment chemicals, such as carbon, to improve water quality. The normal dosage levels of potassium permanganate range from 0.5 to 2.5 mg/l, but higher dosages may be required for more highly contaminated waters. Finally, potassium permanganate is safe and easy to handle. (Halterman-PTT)
W86-02208

ACTIVATED CARBON FOR TASTE AND ODOR CONTROL,
Westvaco Corp., Covington, VA. Carbon Dept.
B. H. Kornegay.
IN: Water Treatment Plant Designfor the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 481-496, 12 fig, 9 ref.

Descriptors: *Activated carbon, *Water treatment, *Chemical treatment, *Drinking water, Potable water, Taste odors, Odor control, Filtration, Adsorbants, Carbon.

The history of the use of activated carbon is discussed, including its early use in the 1920s in the chemistry industry. Since that time, powdered activated carbon has become the most widely used method of taste and odor control. Comparative laboratory testing is the most effective method for evaluating the cost-effectiveness of various carbons, but, in the absence of these data, the iodine number should be used as the basis of selection. Granular activated carbon systems are increasing in number and may be more cost-effective for severe taste and odor problems. The carbon also serves as a filter medium when applied in conventional systems. Therefore, adsorption, filtration and backwash must be considered in design. (Halterman-PTT)
W86-02209

CHEMICAL CONDITIONING FOR WATER SOFTENING AND CORROSION CONTROL,
Brown and Caldwell, Walnut Creek, CA.
D. T. Merrill.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 497-565, 21 fig, 9 tab, 18 ref.

Descriptors: *Water treatment, *Chemical treatment, Drinking water, Potable water, Corrosion, *Corrosion control, Water softening, Water treatment facilities.

The use of Caldwell-Lawrence diagrams to analyze and solve corrosion control problems is described. The diagrams provide a means to assess rapidly and accurately the condition of raw and finished waters, the type and amount of chemicals required to produce the finished water, and the amount of chemical precipitates formed. Insights that are not generally available through the inspection of gross analytical parameters are obtained by the use of these diagrams. Examples of the use of these diagrams in rational analyses of water processing alternatives are provided. (Halterman-PTT)
W86-02210

LIME-SODA SOFTENING PROCESSES,
Greeley and Hansen, Chicago, IL.
C. W. Reh.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 567-596, 10 fig, 7 tab, 21 ref.

Descriptors: *Water treatment, *Chemical treatment, *Water softening, Drinking water, Potable water, Water treatment facilities, Water analysis.

The design of lime softening facilities for municipal plants involves the application of basic water chemistry to continuous, uninterrupted flow regimens to produce a finished water with desirable, consistent and predictable characteristics and properties. Lime-soda ash-caustic softening includes a number of flow patterns, a wide variety of equipment components, and accessory equipment for process control and sludge disposal. Alternate processes and bases for selection, process elements, specialized equipment and bases for selection, process elements, specialized equipment and tankage for the softening operations, and overall softening process control are discussed in detail. (Halterman-PTT)
W86-02211

ION EXCHANGE,
Montana State Univ., Bozeman.
R. L. Sanks.
IN: Water Treatment Plant Design for the Practicing Engineer, Ann Arbor Science, Ann Arbor, MI, 1982. p 597-622, 13 fig, 5 tab, 10 ref.

Descriptors: *Water treatment, *Ion exchange, Chemical treatment, Drinking water, Potable water, Anion exchange, Cation exchange, Resins.

Background information on ion exchange is provided to enable engineers to make preliminary designs, evaluate costs, optimize capital and operating costs, and to guide the manufacturer toward a final design that approaches the optimum. The properties of strong acid, weak acid, strong base, weak base, and intermediate (difunctional) base exchangers are discussed. The design procedure is outlined as follows: select the resin to be used, determine pretreatment requirements, select regenerant level, select the regeneration contact time, recheck the capacity of the resin as a function of the raw water analysis, recheck the capacity vs. the service flow rate, check the leakage of hardness cations, calculate backflow rate, determ pressure drop within the resin beds, and fina compute the operating cycle by determining time required for all operations and compute amount of water treated. Methods of making th determinations and for making estimates on costs of operating this system, are provided. (H terman-PTT)
W86-02212

WATER QUALITY IMPROVEMENT BY R VERSE OSMOSIS,
I. Nusbaum, and A. B. Riedinger.
IN: Water Treatment Plant Design for the Prac ing Engineer, Ann Arbor Science, Ann Arbor, 1982. p 623-652, 8 fig, 4 tab, 16 ref.

Descriptors: *Water treatment, *Drinking wa *Reverse osmosis, *Ultrafiltration, Potable wa Membrane processes, Filtration, Bacteria, Viru Radioactive wastes.

Reverse osmosis and ultrafiltration, two types pressure-driven membrane systems, are proce that are capable of water quality enhancem above and beyond that of conventional wa treatment. The term reverse osmosis usually plies to the separation of ionic or low molecu weight species from a solvent, usually water, b process involving osmosis. The molecular dim sions of the solute are within one order of mag tude of that of the solvent. Operating pressures reverse osmosis, as applied to dissolved solids c centrations of up to 10,000 mg/l, are usually in range of 300 to 600 psi. Ultrafiltration, on the ot hand, is a filtration process, utilizing a por membrane, which is used on bacteria, viruses colloidal and high molecular weight dissolved ganic substances. Several characteristics of reve osmosis are described to provide engineers with understanding of the operational requirements performance of these systems. Included in the cussion are concentration polarization; specific and compound rejection; effects of temperatu compaction, pH and total dissolved solids. Ap cations to removal of organic compounds, bacte viruses, pyrogens, radioactive substances and ga are detailed. (Halterman-PTT)
W86-02213

TECHNIQUES AND MATERIALS FOR PR VENTING CORROSION,
American Paint Journal Co., New York.
A. Banov, and H. J. Schmidt.
IN: Water Treatment Plant Design for the Prac ing Engineer, Ann Arbor Science, Ann Arbor, 1982. p 653-674, 6 tab, 6 ref.

Descriptors: *Water treatment, *Water treatme *Coatings, *Linings, Sealants, Epoxy resi Rubber, Elastomers, Zinc.

Because chemicals involved in water treatment a severe burden on surface materials, selection proper coating for surfaces is critical. Guidance selecting the proper coating for surfaces un mild service conditions are provided. Selection materials, surface preparation, application and spection techniques are outlined. A variety of co ings and linings are discussed, including acryli epoxies, fluorocarbons, chlorinated rubber, phe resins, polyesters, silicones, vinyls, urethanes, el tomeric urethanes, metalizing sealers, neopre chlorinated polyether, inorganic zinc, chloros fonated polyethylene, asphalt, rubber linings, c tar epoxy, and furane resins. Two highly ra combinations of coatings are (1) a urethane mo ture-cure primer, a two-component aromatic u thane intermediate coat, and a two-component phatic urethane topcoat, and (2) an inorganic z primer, a two-component epoxy/polymide int mediate coat and a high-build urethane topco (Halterman-PTT)
W86-02214

DESIGN OF GRANULAR-MEDIA FILT UNITS,
Montana State Univ., Bozeman. Dept. of Ci Engineering and Engineering Mechanics.
A. Amirtharajah.

N: Water Treatment Plant Design for the Practic-
g Engineer, Ann Arbor Science, Ann Arbor, MI,
982. p 675-737, 14 fig, 10 tab, 48 ref.

escriptors: *Water treatment, *Water treatment
cilities, *Filtration, *Filter media, Drinking
ater, Potable water, Backwash, Pretreatment of
ater, Filter rate, Filters.

ranular-media filtration, the final solid-liquid sep-
ation process in water treatment, is described.
he major filtration principles that effect design of
iltration system include pretreatment, filtration
te, water quality, filter media, run length, back-
ashing, and the influence of polyelectrolytes. The
e of these principles is illustrated with typical
ocess design calculations, including data on
sign flow, filtration rate, filter media, underdrain
stem, filter dimensions, filter operational data,
ckwash system and the conduit system. A plan
d section view of the filter block design are
ovided. (Halterman-PTT)
86-02215

TIMATING WATER SYSTEM COSTS,
ontgomery (James M.), Inc., Pasadena, CA.
D. Dickson.
: Water Treatment Plant Design for the Practic-
Engineer, Ann Arbor Science, Ann Arbor, MI,
2, p 763-799, 8 fig, 8 tab, 5 ref.

scriptors: *Drinking water, *Water treatment,
ater treatment facilities, *Costs, Potable water,
t analysis, Economic aspects, Construction
ts, Estimated costs, Maintenance costs, Operat-
costs.

e need to estimate the costs of the various
nponents of a water treatment system, prior to
king a final selection, has resulted in the devel-
nent of two systems of indices which are nor-
ly used within the water works industry. These
referred to as the 'Engineering News-Record'
the 'Handy-Whitman' indices. The history of
t indices, the development of cost curves, the
of cost curves, the operation and maintenance
t-estimating procedures, reservoir costs, pump-
station costs, pipeline costs, and water treat-
t plant costs are discussed. A comparison of
t curves is provided to illustrate different indi-
and variations in cost projections for different
es of facilities. (Halterman-PTT)
6-02216

& M MANUALS AND OPERATOR TRAIN-
;
an (T.M.), Inc., Lexington, KY.
M. Regan.
Water Treatment Plant Design for the Practic-
Engineer, Ann Arbor Science, Ann Arbor, MI,
2. p 805-814.

criptors: *Water treatment, *Water treatment
ity, *Training, Drinking water, Potable water,
ration policies, Administration, Maintenance.

ious aspects of operation and maintenance (O
I) manuals, and operator training programs are
ussed. The O and M manuals are effective
gn tools if started during the early stages of the
gn process, focusing attention on the physical
ational problems of the facility. The need for
er operator training is also discussed. Of pri-
importance is the use of the O and M manual
training text. If properly prepared and under-
d by operating personnel, the O and M manual
be the greatest single factor affecting the effi-
operation of the facility. (Halterman-PTT)
-02217

TER SUPPLY AND SANITATION IN DE-
OPING COUNTRIES,
Arbor Science, Ann Arbor, MI. 1982. Edited
Eric J. Schiller and Ronald L. Droste. 368 p.

riptors: *Water supply development, Devel-
g countries, *Sanitation, *Water treatment,
stewater treatment, Water supply, Public
h, Water resources development, Water man-
ent, Training, Economic aspects, Social as-
, Waste disposal, Project planning.

This book is a revised and improved version of the material from a course given at the University of Ottawa during June 1981. Planning for this course evolved from an International Development Research Center (IDRC)/Canadian International Development Agency (CIDA) man-power training project and workshops that were conducted in East and Southern Africa during 1978-1980. As a result of extensive cooperation with overseas personnel, the dual emphases of renewable energy technologies and social, management and economic aspects emerged. These two foci provide the main outline for this book. This book gives a comprehensive coverage of the technical and management aspects of implementing water supply and sanitation systems in developing countries. It should prove valuable for both technical and non-technical personnel who want to orient themselves to these activities. The text is divided into four sections. Section 1 deals with water supply technologies. Section 2 considers low-cost sanitation options. Section 3 deals with management aspects, and Section 4 discusses interfacing programs with developing countries. (Geiger-PTT)
W86-02324

WATER SUPPLY AROUND THE WORLD--APPROPRIATE TECHNOLOGY,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. A. Okun.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 9-21, 11 fig.

Descriptors: *Water supply development, *Developing countries, *Sanitation, *Water treatment, *Wastewater treatment, Water supply, Water resources development, Water management, Economic aspects, Waste disposal, Project planning, Automation, Capital costs, Labor.

While it is not likely that a community will opt for improved sanitation ahead of water supply, the commitment should be made to both at the same time. In developing countries, water supply and sanitation facilities are often not yet available to people in rural areas, villages and many urban areas. The principles on which water supply and sanitation facility design and operation are based are the same in developed and developing countries. The only difference is that in developing countries, the facilities may be more labor-intensive than capital intensive. Since water supply and wastewater collection and treatment facilities are often among the most expensive and prominant of all investments made by communities in developing countries, the most modern technologies are usually opted for, over less costly and usually more adequate conventional technologies. Not only does the use of excessive technology detract funds from higher-priority needs, but investment in this technology becomes a heavy liability. Examples of the use of inappropriate technology for water treatment in Africa and Asia are given. (Geiger-PTT)
W86-02325

REGIONALIZATION OF WATER SUPPLY AND SANITATION SERVICES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. A. Okun.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 23-35, 1 fig, 6 ref.

Descriptors: *Regional development, *Water supply development, *Developing countries, *Sanitation, *Water management, Water supply, Water resources development, Training, Economic aspects, Social aspects, Political aspects, Wastewater facilities, Wastewater treatment, Waste disposal, Project planning, Wastewater disposal.

In 1945, the British initiated a program of regionalization of water supplies to optimize investments in water supply, wastewater collection and disposal, river regulation, and the amenity uses of inland waters. The uniqueness of water projects in relation to climate, precipitation, topography, density and distribution of population, industrial development, land use, economic status, availability of human resources, and social structure and customs must be recognized. The need for pure water supplies is important in developing countries where infectious diseases are more likely to spread. Integration of wastewater collection and disposal with water supply is particularly appropriate in arid and semiarid areas of the world where reclaimed wastewaters are used for nonpotable purposes. Integration of these services can afford efficiencies and economies of scale similar to those obtained by regionalization. When adopting a regionalization approach in developing countries, certain guidelines should be followed. The region should encompass people of the same cultural background. The region should be close to regional headquarters, or be large enough to have its own headquarters. The region should conform to political boundaries and should have potential for education and training centers, and be able to manage its own facilities. (Geiger-PTT)
W86-02326

HAND-PUMP TECHNOLOGY FOR THE DEVELOPMENT OF GROUNDWATER RESOURCES,
Agency for International Development, Washington, DC.
For primary bibliographic entry see Field 8C.
W86-02327

RENEWABLE ENERGY PUMPING FROM RIVERS AND STREAMS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8C.
W86-02328

WIND-POWER PUMPING,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8C.
W86-02329

ROOFTOP RAINWATER CATCHMENT SYSTEMS FOR DRINKING WATER SUPPLY,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 3B.
W86-02330

SIMPLE WATER TREATMENT METHODS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
R. L. Droste, and F. E. McJunkin.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor, MI, 1982. p 101-122, 10 fig, 2 tab, 38 ref.

Descriptors: *Water treatment, *Water quality, *Chlorination, *Developing countries, *Filtration, Sand filters, Water supply, Water supply development, Aeration, Flocculation, Coagulation, Disinfection, Heavy metals, Enteric bacteria, Coliforms, Public health.

In less developed countries, the general rule for water treatment is to provide the minimum treatment necessary. A good water source is the first protective barrier against waterborne disease. Microbiological quality is the major measure of the quality of water. Fecal coliform and streptococcus serve as indicator organisms of microbiological purity. In developing countries, nitrates can cause methemoglobinemia in infants under 3 months of age. Fluorides in moderate amounts are desirable to prevent dental caries. Other dissolved inorganic salts affect the taste of water and can cause a temporary laxative effect. Fe and Mn cause staining of fixtures and clothes and contribute taste and odors. In developing countries, operation and maintenance of water treatment plants is the responsibility of national or regional governments. Storage of water supplies offers additional protection against emergency water demands. Aeration, filtration and chlorination are common practices for the treatment of water. Sand filtration may be

incorporated into source protection by using an infiltration gallery. There are a number of simple chlorination devices that can be used if the supply of solid chlorine is assured. (Geiger-PTT)
W86-02331

COST-EFFECTIVE WATER SUPPLY AND SANITATION PROJECTS FOR DEVELOPING COUNTRIES,
International Bank for Reconstruction and Development, Washington, DC. Dept. of Transportation and Water.
For primary bibliographic entry see Field 6C.
W86-02337

FINANCING WATER SUPPLY SYSTEMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6C.
W86-02338

PROCESS OF PROJECT PREPARATION,
Walker and Partners Ltd., Ottawa (Ontari).
For primary bibliographic entry see Field 6B.
W86-02339

OPERATION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS,
Walker and Partners Ltd., Ottawa (Ontari).
For primary bibliographic entry see Field 5D.
W86-02341

TRAINING OF COUNTERPARTS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 9A.
W86-02342

5G. Water Quality Control

ACID MINE DRAINAGE: CONTROL AND ABATEMENT RESEARCH,
Bureau of Mines, Pittsburgh, PA. Pittsburgh Research Center.
For primary bibliographic entry see Field 5D.
W86-01978

ASSESSMENT AND CONTROL OF WATER CONTAMINATION ASSOCIATED WITH SHALE OIL EXTRACTION AND PROCESSING,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 5B.
W86-01979

MECHANISMS FOR GROUNDWATER CONTAMINATION BY UCG: PRELIMINARY CONCLUSIONS FROM THE HOE CREEK STUDY,
Lawrence Livermore National Lab., CA.
For primary bibliographic entry see Field 5B.
W86-01981

PHYSICAL PROPERTIES AND LEACH TESTING OF SOLIDIFIED/STABILIZED INDUSTRIAL WASTES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5E.
W86-02001

SITING HAZARDOUS WASTE MANAGEMENT FACILITIES: THEORY VERSUS REALITY,
Boston Univ., MA. Dept. of Urban Affairs and Planning.
R. F. Anderson, and M. R. Greenberg.
IN: Hazardous and Toxic Wastes: Technology, Management and Health Effects, The Pennsylvania Academy of Science, Easton, PA. 1984. p 170-186, 2 fig, 6 tab, 29 ref.

Descriptors: *Water quality control, *Waste disposal, *Landfills, New Jersey.

A site screening method is useful in making decisions for locating new hazardous waste sites. Applied to 46 known disposal sites in Lower Raritan/Middlesex County 208 Water Management Area, central New Jersey, the method shows that most of these sites are not acceptable according to criteria in the proposed method. The 272 cells of 2 x 2 kilometers each were evauated according to 22 criteria, grouped into 9 composite statistical factors. Each cell rated 1-4 (most suitable to least suitable) in each of the 9 categories. A composite rating (1-5) was developed, 1 having the largest number of most suitable ratings and 5 having more than one least suitable ranking. Of the 38 most suitable cells, only 4 contain existing landfills. The other 42 landfills in this region, including the Kin-Buc landfill in Edison, are situated in land unsuitable for this purpose. (Cassar-PTT)
W86-02045

ENVIRONMENTAL IMPACT OF POLLUTION CONTROLS ON THE THAMES ESTUARY, UNITED KINGDOM,
Thames Water Authority, Reading (England).
P. Casapieri.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 489-504, 4 fig, 4 tab, 11 ref.

Descriptors: *Water quality control, *Estuaries, *Management, *Thames River, *United Kingdom, Water pollution control, Water pollution sources, Dissolved oxygen, Oxygen, Legislation, Wastewater treatment, Aquatic habitats, Habitats, Fish, Salmon, Standards, Water quality standards, Rivers, Tidal rivers.

The Thames River Estuary, badly polluted with industrial and human waste since the 18 century, has been recovering in recent years. Dissolved oxygen levels started to improve about 1870, following pollution control legislation in 1857. However, starting about 1900, dissolved oxygen again decreased, reaching zero for the period 1940-1965. In 1973 the 1600 separate water authorities responsible for pollution control in England and Wales were reorganized into 10 regional water authorities. Environmental quality objectives were developed by the Pippard Committee. Beginning with dissolved oxygen goals (minimum of 1 mg/liter), the next step was a management strategy to establish dissolved oxyten levels suitable for a migratory fish habitat. Six classes of rivers were defined, each with water quality objectives and standards. Likewise, tidal waters were classified into five categories. One measure of water quality is the number of fish species recorded in the Key-Gravesend reach. This has increased from <5 in 1964 to 50 in the late 1960's to nearly 100 in 1980. A 17-year salmon introduction project started in 1979 has yielded salmon caught by rod and reel and by electrofishing. (Cassar-PTT)
W86-02093

TREATMENT ALTERNATIVES FOR GROUNDWATER CONTAMINATION,
Montgomery (James M.), Inc., Reston, VA.
For primary bibliographic entry see Field 5F.
W86-02110

INVESTIGATION INTO THE WATER QUALITY BENEFITS OF CHLORINATING PAPER-MILL EFFLUENTS,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 5D.
W86-02112

CONSTRUCTION TECHNIQUES FOR REMEDIAL DESIGN AT A CONNECTICUT SUPERFUND SITE: A CASE STUDY,
Hart (Fred C.) Associates, Inc., New York.
B. D. Gillen, and D. E. Webster.
IN: Toxic and Hazardous Wastes, Technomic Publishing Co., Lancaster, PA. 1984. p 497-509, 6 fig, 1 tab, 3 ref.

Descriptors: *Water pollution control, *Trench
*Design criteria, *Landfills, *Drains, *Sew
Ditches, Leachates, Dewatering, Leaching, C
analysis, Waste disposal, Land disposal, Wa
dumps, Sanitary landfills, Case studies.

The methods of construction and some design c
siderations used during the installation of a lea
ate collection trench drain at a landfill in Conne
cut is described. The problems related to m
uniform soil conditions were remedied by u
finer till from other stockpiles onsite. Compact
was improved creating a temporary till dam acr
the trench to retain liquids long enough to all
till to be placed on the trench bottom. Permeabil
tests were lengthy and pre-testing of sites is reco
mended. Dynamite blasting at the site caused
sures through which leachate could travel.
epoxy sealant was applied to prevent leach
escape through fissures. The manholes at
bottom of downgradient barriers had to be
rounded with an impermeable barrier to prev
leakage from the system. The entire system, incl
ing a trunk line to connect the collection drain
the existing sanitary sewer, was installed for ab
$400,000. The sytem currently collects appro
mately 20,000 gpd, an amount which may decre
over time as the groundwater level drops. (Geig
PTT)
W86-02118

**HAZARDOUS WASTE MANAGEMENT F
THE 80'S.**
For primary bibliographic entry see Field 5E.
W86-02219

**USE OF AERIAL PHOTOGRAPHY A
REMOTE SENSING IN THE MANAGEME
OF HAZARDOUS WASTES,**
Ohio State Univ., Columbus.
J. G. Lyon.
IN: Hazardous Waste Management for the 8
Ann Arbor Science, Ann Arbor, MI, 1982. p 1
171, 18 ref.

Descriptors: *Aerial photography, *Remote se
ing, *Infrared imagery, *Landfills, *Waste disp
al, Groundwater, Industrial wastes, Solid wast
Liquid wastes, Site selection, Environment.

Aerial photographs and remote sensor data
useful in providing both current and histori
information on sites of hazardous wastes, and i
demonstrated that these tools can save money a
human resources and can reduce toxic waste ex
sure. Historical photographic data can determ
presence or absence of landfills, subsequent la
use on closed landfills, and historical vegetati
soil and hydrological conditions. Current data c
assist in the monitoring of soil and water con
tions, in defining the chaacteristics of vegetati
cover, and in helping to prioritize abatement
tivities. Both siting and closure of hazardous wa
sites can be facilitated by use of these techniqu
Color infrared photography is valuable for mo
toring water characteristics, since very thin lay
of water can be distinguished. This is useful
locating leachate movement, ponding of wat
erosion and condition of diversions. Aerial pho
graphs have been acquired in the United States
a consistent basis since 1936. Information
sources for obtaining these photographs is giv
(Halterman-PTT)
W86-02224

**REMEDIAL ACTION ALTERNATIVES FO
ABANDONED HAZARDOUS WASTE SITES,**
P. B. Lederman.
IN: Hazardous Waste Management for the 8
Ann Arbor Science, Ann Arbor, MI, 1982. p 2
276, 4 fig, 3 tab.

Descriptors: *Wastes, *Waste disposal, *Enviro
ment, *Cleanup, On-site investigations, So
wastes, Liquid wastes, Landfills, Industrial wast

Various alternatives available for remedial acti
(cleanup) of abandoned hazardous waste si
(which will generally be pits, barrel repositories
burial grounds) are considered. After a field inv

tigation has revealed the extent and type of contamination and sources of material (inventory), a judgment is made on the appropriate action. The alternatives to be considered include no action, site management, stabilization and closure, encapsulation, fixation, on site treatment, off-site secure landfill, or off-site treatment. The use of field tests, pilot studies, financial considerations, and assessment of risk of failure, to determine the most appropriate courses of action are discussed. (Halterman-PTT)
W86-02225

SLURRY TRENCH CUTOFF WALLS FOR HAZARDOUS WASTE ISOLATION,
D. J. D'Appolonia.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI, 1982. p 289-305, 12 fig, 2 tab, 2 ref.

Descriptors: *Trenches, *Waste management, *Design criteria, *Waste disposal, *Cutoffs, Solid wastes, Liquid wastes, Environment, Landfills, Leachates.

Soil-bentonite slurry trench cutoff walls are an effective tool for isolating chemical and industrial waste materials that are disposed of in landfills or ponds. They can provide a vertical barrier around a disposal site without uncovering or disturbing the waste. The geological conditions where slurry trench construction is most applicable are reviewed, as are the important elements of slurry trench design. Critical design considerations include the connection details between the cutoff and the underlying aquaclude and the blend of soils and bentonite used for the landfill. In order to obtain a low permeability , containment-resistant backfill, a high percentage of fine plastic material must be used. A clayey sand or sandy clay containing 30 to 60 percent fines blended with bentonite slurry is usually satisfactory for most waste isolation applications. (Halterman-PTT)
W86-02226

CLAY LINER PERMEABILITY - A PROBABILISTIC DESCRIPTION,
Carnegie-Mellon Univ., Pittsburgh, PA.
For primary bibliographic entry see Field 5E.
W86-02227

CONTAINMENT AND ENCAPSULATION OF HAZARDOUS WASTE DISPOSAL SITES,
For primary bibliographic entry see Field 5E.
W86-02228

ESTIMATES OF SEEPAGE THROUGH CLAY COVERS ON HAZARDOUS WASTE LANDFILLS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W86-02229

MONITORING, RECOVERY AND TREATMENT OF POLLUTED GROUNDWATER,
R. Quince, and G. L. Gardner.
IN: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI, 1982. p 357-369, 13 fig, 2 tab.

Descriptors: *Groundwater pollution, *Industrial wastes, *Water treatment, Environment, Groundwater recharge, Water quality, Biological treatment, Chemical treatment.

An overview of techniques currently applied to recover and treat polluted groundwater is presented. The process consists of several steps: A preliminary investigation of existing site conditions, selection of a method of recovery (usually gravity collection, suction lift or positive displacement), selection of a treatment system based on the contaminant(s) being recovered, use of treatment system effluent for aquifer recharge, and monitoring. Four case histories encompassing a variety of contaminants are presented to illustrate the procedure. Treatment steps can be divided into three primary classifications: physical, chemical and biological. Physical techniques employ phase or component separation. Chemical treatment techniques employ the addition of a reactive material to provide for a change in chemistry of the waste stream. Biological treatment uses enhanced mirobiological activity to convert contaminants to non-toxic by-products. In situ recovery and treatment techniques including biodegradation have proven more effective than excavation and disposal of contaminated material. (Halterman-PTT)
W86-02230

SALINITY IN WATERCOURSES AND RESERVOIRS,
For primary bibliographic entry see Field 5B.
W86-02264

EVOLUTION OF A COST SHARING POLICY FOR FEDERAL CHLORIDE PROJECTS,
Army Engineer Div. Southwestern, Dallas, TX.
For primary bibliographic entry see Field 6C.
W86-02266

PROBLEM OF SALINITY AND ITS CONTROL, RIVER MURRAY, AUSTRALIA,
River Murray Commission, Canberra (Australia).
For primary bibliographic entry see Field 5B.
W86-02267

DRAINAGE AND SALINITY CONTROL PROGRAMS IN PAKISTAN,
International Bank for Reconstruction and Development, Washington, DC.
W. D. Fairchild.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 43-52.

Descriptors: *Saline water; *Salinity, Irrigation, Water requirements, Water supply, Water use, Water users, Economic aspects, Pakistan, Indus Basin, Groundwater.

Several salinity-related water sector programs in Pakistan are outlined and the similarities with the Colorado Basin situation are discussed. Pakistan has up to 1.6 megahectares underlaid with saline groundwater that fits their 'disaster' classification of having a continuous high water table of less than 1.5 meters. Recommendations concerning salinity control included: exploitation of fresh groundwater resources by the private sector; implantation of a program to transfer operation and maintenance of existing public tubewells in fresh groundwater zones to the private sector; and placing high priority on control of waterlogging in saline groundwater zones in future investment programs. (Halterman-PTT)
W86-02268

LEGAL AND INSTITUTIONAL CONSTRAINTS TO SALINITY CONTROL,
Bureau of Reclamation, Provo, UT. Utah Projects Office
For primary bibliographic entry see Field 6E.
W86-02269

USDA PLANNING PROCESS FOR COLORADO RIVER BASIN SALINITY CONTROL,
Soil Conservation Service, Portland, OR. West National Technical Center.
H. D. Hedlund.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 63-77, 2 fig, 2 tab, 20 ref.

Descriptors: *Salinity, *Saline water, *Irrigation, *Irrigation procedures, Water requirements, Irrigation requirements, Water supply, Water use, Water users, Colorado River, Colorado River Basin.

Several aspects of the USDA program for salinity control in the Colorado River Basin are reviewed. The planning process consists of the following six major steps: define the problem (quantification of the salinity problem); inventory and analysis (inventory of on-farm practices and analytical procedures to evaluate conditions); formulate alternative plans (determination of possible treatment opportunities); prepare displays of effects and compare alternative plans (displays aid in identification of tradeoffs between alternatives); and select the recommended plan (includes consideration of acceptability by local farmers and ranchers and the obligation to meet national and international water conservation and interstate water quality goals). Several on-going programs, including the Wellton-Mohawk, Grand Valley and Vinta Basin, are discussed. (Halterman-PTT)
W86-02270

SALINITY BUBBLES AND OFFSETS: A CONCEPT PAPER,
Environmental Protection Agency, Denver, CO. Water Management Div.
G. R. Reetz.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 79-91, 30 ref.

Descriptors: *Salinity, *Saline water, Irrigation, Irrigation procedures, Water requirements, Irrigation requirements, Water supply, Water use, Water users, Colorado River, Colorado River Basin, Legal aspects, Legislation.

The impacts of salinity and the principles of a bubble/offset policy for environmental protection are discussed and the specifics of the problem of salinity in the Colorado River are described. Impacts on land and water uses include reduced crop yield, additional municipal water treatment costs, and increased corrosion and wear at water treatment facilities. The bubble concept applies to the practice of a facility rearranging emission control requirements, decreasing controls where control costs are high in exchange for increased controls where costs are low. The offset policy permits a new facility to enter a non-attainment area, provided the firm offsets its emissions with emission reductions obtained from existing firms in the non-attainment area. As related to Colorado River salinity control, the state of California recommended a bubble (the salinity concentrations at a particular time) bounded by the outflow from the Upper Basin, and recommended a basinwide offset policy for maintaining the bubble. The flexibility of the bubble and offset concepts, and their appropriateness for controlling salinity in the Colorado River Basin are discussed.
W86-02271

PLANNING AND IMPLEMENTATION FRAMEWORK FOR SALINITY CONTROL IN THE INDUS RIVER BASIN,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
M. S. Shafique, and G. V. Skogerboe.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 93-102, 3 fig, 1 tab, 5 ref.

Descriptors: *Saline water, *Salinity, Irrigation, Water requirements, Water supply, Water use, Water users, Economic aspects, Pakistan, Indus River, Groundwater.

The planning phase of salinity control in the Indus River Basin, Pakistan, included several steps. First, evaluation of alternatives for each individually irrigated area leads to practices that can effectively control salinity resulting from the use of water for irrigation. The second step is to define the best management practices by optimizing the cost-effectiveness relationships from individual areas into a single strategy. The third step assigns the required level of salinity control that should be implemented in each subbasin or irrigated area. The role of farmer organizations, monitoring, and evaluation in assuring the effectiveness of ongoing programs are discussed. (Halterman-PTT)
W86-02272

SOUTHWESTERN SALINITY SITUATION: THE ROCKIES TO THE MISSISSIPPI,
Army Engineer Div. Southwestern, Dallas, TX.
For primary bibliographic entry see Field 5B.
W86-02274

NATURAL SALT POLLUTION CONTROL BRAZOS RIVER BASIN, TEXAS,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 5B.
W86-02276

IMPROVING WATER MANAGEMENT PRACTICES ON SURFACE IRRIGATED LANDS: THE ROLE OF MODELING,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
W. R. Walker.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston, 1984. p 203-211, 4 fig, 1 tab, 13 ref.

Descriptors: *Salinity, *Saline water, *Irrigation, *Water quality control, Model studies, Irrigation design, Irrigation efficiency, Irrigation practices, Irrigation return flow.

Some of the faulty modeling assumptions made about uniform application of irrigation water, and the resultant bias of the results which favor off-farm salinity control options, are discussed. The need for more realistic irrigation models is stressed, and state-of-the-art models are described. Hydrodynamic, zero-inertia, kinetic-wave and volume balance models are outlined. Several ways in which surface irrigation models can be helpful are discussed. For instance, after an on-farm salinity control measure has been implemented at a structural level, the model can be used in conjunction with other management tools to improve and maintain effective irrigation practices. The use of surface irrigation models to predict the use of surge flow, cablegation, cutback, or tailwater reuse systems is also discussed. (Halterman-PTT)
W86-02282

LONGITUDINAL-VERTICAL HYDRODYNAMICS AND TRANSPORT WITH CHEMICAL EQUILIBRIA FOR LAKE POWELL AND LAKE MEAD,
Edinger (J.E.) Associates, Inc., Wayne, PA.
For primary bibliographic entry see Field 5B.
W86-02283

SKIMMING WELL MODEL FOR SALINITY CONTROL,
California Univ., Davis. Dept. of Civil Engineering.
B. A. Chandio, and B. E. Larock.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 235-242, 3 fig, 7 ref.

Descriptors: *Salinity, *Saline water, *Groundwater, *Water quality control, Model studies, Irrigation practices, Well hydraulics, Well water, Shallow water, Skimming.

A three-dimensional miscible fluid model of transient unconfined flow toward a skimming well is described and the role of such a model in salinity control is discussed. The ability to predict or control the distribution of salinity with skimming wells depends on knowledge of the hydromechanics of flow near the well. Important geometric factors that effect the hydromechanics, and thus the well operation, are described. Various well-operation strategies, such as depth and duration of pumping, can be tested for a suitable set of geometric parameters. In this way, the optimum means of skimming water from the relatively thin band of fresh groundwater which overlies a thicker saline water layer in an unconfined aquifer, can be determined. However, owing to the use of linear elements in the model, computations employing a larger, finer mesh of elements is suggested. (Halterman-PTT)
W86-02285

SALINITY CONTROL THROUGH WATER CONSERVATION IN THE UPPER COLORADO RIVER BASIN,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 3F.
W86-02286

IRRIGATION WITH SALINE GROUNDWATER AS A STRATEGY FOR SALINITY CONTROL IN THE SHEPPARTON REGION OF NORTHERN VICTORIA,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
For primary bibliographic entry see Field 3C.
W86-02287

CASE STUDY OF A SALINITY CONTROL PROGRAM, VINTA BASIN, UTAH,
Soil Conservation Service, Salt Lake City, UT.
H. T. Brown.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 275-284, 1 fig, 1 tab, 6 ref.

Descriptors: *Salinity, *Saline water, Groundwater, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agricultural hydrology, Agriculture, Vinta Basin, Utah.

Poor irrigation practices and natural salt sources resulted in increased total dissolved solids entering streams near irrigated lands. Technical assistance from the Soil Conservation Service and the Agricultural Stabilization and Conservation Service was initiated, at a cost of about $0.5 million per year, to control the salinity problem. Pasture management, irrigation water management, wildlife habitat management, land leveling and reservoir regulation are included in the salinity control program. It is estimated that 69,475 metric tons of salt-loading from the irrigated area can be eliminated from the Colorado River system annually. On-site benefits, including lower operating costs and higher crop yields, are also discussed. (Halterman-PTT)
W86-02289

CASE STUDY OF A MAJOR AGRICULTURAL CONTROL PROGRAM - THE GRAND VALLEY EXPERIENCE,
Soil Conservation Service, Denver, CO.
For primary bibliographic entry see Field 3F.
W86-02290

GRAND VALLEY STATE ONE MONITORING PLAN AND IMPLEMENTATION,
Bureau of Reclamation, Grand Junction, CO.
D. L. King.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 295-304, 3 fig, 2 tab, 3 ref.

Descriptors: *Salinity, *Saline water, Groundwater, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agricultural hydrology, Agriculture, Colorado River.

In order to improve groundwater flows and reduce salt loading, a 6.8 mile length of the Government Highline Canal was lined with concrete, and cross-drainage facilities were installed. To assess the effectiveness of these improvements, a hydrologically-closed basin, known as the Reed Wash study area, has been equipped to monitor surface and groundwater inflows, outflows, and levels. A monitoring program, implemented to establish preconstruction hydrologic conditions and to observe the effects of canal lining and lateral piping on salt loading in the watershed, is discussed. The monitoring program indicates that the water system improvements have been effective in reducing seepage and salt loading from canals and laterals. This area will be monitored for a number of years to verify the effectiveness of the lining program. (Halterman-PTT)
W86-02291

MEASURES FOR REDUCING RETURN FLOWS FROM THE WELLTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT,
Bureau of Reclamation, Boulder City, NV. Lower Colorado Region.
R. J. Effertz, W. K. Sidebottom, and M. D. Turley.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 305-314, tab.

Descriptors: *Salinity, *Saline water, Groundwater, Irrigation, Irrigation effects, Irrigation practices, Environmental effects, Economic aspects, Agricultural hydrology, Agriculture, Colorado River.

A variety of measures to reduce salt loading of the Colorado River are discussed. Acreage reduction, on-farm measures and technical assistance are stressed. Research projects that added to irrigation efficiencies and reduction in drainage water included monitoring soil salinity; preventing clogging of emitters in trickle irrigation systems; managing dead-level irrigation; automating surface irrigation; and evaluating economic aspects of alternative irrigation systems. Reduced irrigation acreage and on-farm improvements resulted in significant reductions in the drainage of saline waters into the Colorado River. (Halterman-PTT)
W86-02292

SALINITY CONTROL AND DRAINAGE IN NORTHERN VICTORIA (AUSTRALIA),
Victoria State Rivers and Water Supply Commission, Armadale (Australia).
For primary bibliographic entry see Field 3F.
W86-02293

CONTROLLING SALINITY IN THE COLORADO RIVER BASIN, THE ARID WEST,
Bureau of Reclamation, Denver, CO. Colorado River Water Quality Office.
A. R. Jonez.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 337-347, 3 fig, 5 ref.

Descriptors: *Saline water, *Salinity, *Water quality control, Irrigation, Water use, Irrigation effects, Irrigation practices, Environmental effects, Agriculture, Colorado River, Desalination.

The sources of salt in the Colorado River are discussed. The primary sources are natural (47%), irrigation (37%) and reservoir evaporation (12%). Several activities designed to reduce salt loading and salinity levels in the Colorado River are discussed. They include irrigation source control (land leveling and canal sealing), point source control (removal of salt from localized areas such as mineral springs, abandoned oil wells, and geysers), diffuse source control (watershed management, land treatment and the collection and disposal of irrigation return flows). Major issues and concerns pertaining to salinity control are discussed, and the need for further development in salinity control technology is stressed. (Halterman-PTT)
W86-02295

SALINITY CONTROL BY PUMPING AND DEEP WELL INJECTION - THE PARADOX VALLEY UNIT,
Bureau of Reclamation, Durango, CO.
E. G. Jensen, and R. W. Leach.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 349-358, 6 fig

Descriptors: *Saline water, *Salinity, *Water quality control, Groundwater, Water supply, Colorado River, Colorado, Dolores River, Environmental effects, Well hydraulics, Economic aspects, Hydraulics.

A plan to reduce salinity inputs to the Dolores River, a tributary of the Colorado River, is discussed. The Dolores River picks up an estimated 205,000 tons of salt annually as it passes over a salt anticline in Paradox Valley, Colorado. A control plan which has been adopted involves pumping brine from wells paralleling the Dolores River and adjacent to brine inflow areas. The pumping will lower the freshwater-brine interface below the river channel, thus preventing the brine from entering the river. Brine disposal methods have not been selected; however, disposal in large evaporation ponds, or by deep-well injection, appear to be the most attractive alternatives. (Halterman-PTT)

W86-02296

MEEKER DOME SALINITY INVESTIGATION,
CH2M Hill Central, Inc., Denver, CO.
For primary bibliographic entry see Field 5B.
W86-02297

SALINITY CONTROL BENEFITS THROUGH REGULATION OF PRODUCED WATER,
Utah Bureau of Water Pollution Control, Salt Lake City.
J. R. Riding.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 367-375, 1 tab, 26 ref.

Descriptors: *Saline water, *Salinity, *Water quality control, Groundwater, Water supply, Environmental effects, Well hydraulics, Deep wells, Ponds, Water pollution, Groundwater pollution.

Methodologies are discussed by which 'produced' water (from oil and gas production) is disposed, and salinity loading is minimized. The use of evaporation ponds and injection wells have long been standard practices; however, the need has existed for more stringent regulations regarding these two methods. Regulations recently developed for pond disposal insure that with proper siting, design, construction, and monitoring, minimal ground water contamination will take place. Successful disposal by injection well can be attained if water is injected into formations that are below freshwater zones, and separated from them by impermeable layers to prevent the upward migration of the injected fluids. (Halterman-PTT)
W86-02298

ARKANSAS-RED RIVER BASINS CHLORIDE CONTROL PROJECT: TECHNICAL FEASIBILITY STUDIES FOR PLAN OF CONTROL,
Corps of Engineers, Tulsa, OK.
H. H. Roberts.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 377-387, 8 fig, 1 tab, 2 ref.

Descriptors: *Saline water, *Salinity, *Water quality control, Groundwater, Water supply, Environmental effects, Well hydraulics, Deep wells, Ponds, Water pollution, Groundwater pollution.

A summary of the chloride contamination problem in the Arkansas and Red River Basins is provided, and an overview of technical feasibility studies necessary to develop a control plan is presented. The source of the salt is thick deposits of halite under a large area of the southwestern United States. Salt loading into the Arkansas and Red River Basins has degraded the waters to such a degree that they are unusable for most purposes. Surface water investigations indicate that three separate salt emission areas exist in a study area along Jonah Creek, a tributary of the Red River. Groundwater pump tests have shown that they are also separate hydrologically. Brine collection and disposal methodologies are discussed. The most efficient techniques involve pumping brine to the surface and then disposing of it by means of deep well injection. (Halterman-PTT)
W86-02299

GLENWOOD-DOTSERO SPRINGS SALINITY CONTROL PROJECT,
URS Co., Denver, CO.
D. A. Macko.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 389-396, 1 fig, 1 tab.

Descriptors: *Saline water, *Salinity, *Water quality control, Groundwater, Water supply, Environmental effects, Well hydraulics, Economic aspects, Colorado River, Drainage wells.

Various aspects of a proposed salinity control project, including planning, field investigations, results, and the conclusions, are discussed. The results of the field investigation were used in the design and cost estimates for the components of the recommended plan. Data indicate that a well field could collect approximately 0.20 cu m saline water/sec from the subsurface without dilution from the Colorado River. A computer model was calibrated with aquifer test data and extensive modeling efforts were undertaken to design a well that would not impact upon several nearby commercial springs. Annual reductions in salinity and water depletion rates that would result from the implementation of the recommended plan are discussed. (Halterman-PTT)
W86-02300

SALINITY CONTROL ON THE SMOKY HILL RIVER IN CENTRAL KANSAS,
Kansas State Geological Survey, Lawrence.
C. D. McElwee, A. Fleming, M. Butt, and A. Severini.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 397-406, 7 fig, 2 tab, 5 ref.

Descriptors: *Saline water, *Salinity, *Water quality control, Model studies, Groundwater, Water supply, Well hydraulics, Drainage wells, Relief wells, Smoky Hill River, Kansas.

The possible use of relief wells to alleviate the problem of high salinity in the Smoky Hill River is discussed. Modeling methods are applied to evaluate the effectiveness of various systems. Results indicate that the volume of salt water leakage could be reduced by 20%. In some cases, regional flow can capture about 50% of the freshwater leakage induced by the relief wells, resulting in considerable dilution of the discharged water. The most efficient net effect of the relief-well systems modeled was a reduction of 77-85% in the salt load discharged to the alluvium. The model predicts, however, that most of the dilution effect will not be felt at the discharge area for 40-160 years. (Halterman-PTT)
W86-02301

PRICE/SAN RAFAEL RIVER BASINS SALINITY INVESTIGATION,
CH2M/Hill, Boise, ID.
For primary bibliographic entry see Field 5B.
W86-02302

LIVING WITH SALINITY: AN EVALUATION OF TWO POLICY MEASURES WITHIN A REGIONAL FRAMEWORK.
Hebrew Univ. of Jerusalem (Israel). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3C.
W86-02304

IRRIGATION AS A SOLUTION TO SALINITY PROBLEMS OF RIVER SYSTEMS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 3C.
W86-02305

AQUATRAIN PIPELINE SYSTEM,
Bureau of Reclamation, Denver, CO. Office of Saline Water Transport and Use.
For primary bibliographic entry see Field 3C.
W86-02307

SALT GRADIENT SOLAR PONDS.
Department of Energy, Washington, DC.
For primary bibliographic entry see Field 3C.
W86-02308

FISH AND WILDLIFE MITIGATION PROGRAM FOR THE COLORADO RIVER BASIN SALINITY CONTROL PROJECT - A CASE HISTORY,
Bureau of Reclamation, Boulder City, NV. Lower Colorado Region.
T. A. Burke, D. E. Busch, and W. E. Rinne.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 539-548, 1 tab, 2 ref.

Descriptors: *Saline water, *Salinity, Mitigation, Wildlife conservation, Fish conservation, Arizona, California.

Salinity control measures impact upon fish and wildlife in a variety of ways, including: loss of surface water and associated wetlands in and along the lined canals due to elimination of seepage; loss of vegetation for project rights-of-way; and loss of irrigated croplands in the Wellton-Mohawk area (retired from agricultural use). The development of mitigation strategies designed to offset these, and other losses, are outlined. General mitigation measures include: use of existing main outlet drains as a conveyance channel for salt water wastes; screening the feed water intake to the desalting plant to reduce fish loss; conducting fish salvage during canal dewatering works, and providing bridges, siphons, and escape ladders in and along the canals for both human and wildlife use. Specific mitigation projects for both Arizona and California are detailed. (Halterman-PTT)
W86-02312

TRIANGLE CONSERVATION DISTRICT - A CASE STUDY IN DRYLAND SALINE SEEP CONTROL,
Triangle Conservation District, Conrad, MT.
T. Dodge, J. Holzer, W. Adams, and J. Farkell.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 561-570, 2 fig, 1 tab, 6 ref.

Descriptors: *Salinity, *Saline water, *Seep water, Seepage control, Seeps, Percolation, Environmental effects, Wells, Montana.

Saline seeps, defined as recently developed saline soils in non-irrigated areas, that are wet some or all of the time, are discussed. Control of seeps is obtained by a variety of techniques, including selective crop growth, and pumping ground water out of localized seeps, thus lowering the water table. Farm-by-farm assistance for saline seep control is the quickest and best way to solve the problem. Developing a successful saline plan requires a combination of the 'ideal' solution and practical considerations--economics, land ownership, farm program participation, type of farm operation, etc. Effective saline seep control frequently alters the entire farm operation. The changes in management require technical assistance throughout the implementation stage by a team of agronomic and soil specialists. (Halterman-PTT)
W86-02314

SALINITY CONTROL PROBLEMS: NON-AGRICULTURAL,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 5B.
W86-02316

CRITIQUE - SALINITY CONTROL PROBLEMS: AGRICULTURAL,
Science and Education Administration, Fort Collins, CO. Agricultural Research.
For primary bibliographic entry see Field 5B.
W86-02317

REUSING SALINE DRAINAGE WATERS FOR IRRIGATION: A STRATEGY TO REDUCE SALT LOADING OF RIVERS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3C.
W86-02318

DESALTING BY REVERSE OSMOSIS AT YUMA DESALTING PLANT,
Bureau of Reclamation, Yuma, AZ. Yuma Projects Office.
For primary bibliographic entry see Field 3A.
W86-02319

GEOLOGIC AND HYDROLOGIC DATA COLLECTED DURING 1976-1984 AT THE SHEFFIELD LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE AND ADJACENT AREAS, SHEFFIELE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02372

LITERATURE REVIEW OF SURFACE-WATER QUALITY IN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02388

SELECTED HYDROLOGIC DATA FOR THE SOUTH PLATTE RIVER THROUGH DENVER, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02391

HYDROLOGY OF YUCCA MOUNTAIN AND VICINITY, NEVADA-CALIFORNIA--INVESTIGATIVE RESULTS THROUGH MID-1983,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02413

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

USDA PLANNING PROCESS FOR COLORADO RIVER BASIN SALINITY CONTROL,
Soil Conservation Service, Portland, OR. West National Technical Center.
For primary bibliographic entry see Field 5G.
W86-02270

PLANNING AND IMPLEMENTATION FRAMEWORK FOR SALINITY CONTROL IN THE INDUS RIVER BASIN,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5G.
W86-02272

SALINITY CONTROL ON THE SMOKY HILL RIVER IN CENTRAL KANSAS,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 5G.
W86-02301

6B. Evaluation Process

PROJECTING LAND USE CHANGES ASSOCIATED WITH SMALL WATERSHED DEVELOPMENT,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
For primary bibliographic entry see Field 6G.
W86-01976

ECONOMIC EVALUATION OF SALINITY CONTROL,
Corps of Engineers, Tulsa, OK.
R. D. Brown.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 125-134, 2 fig. 2 ref.

Descriptors: *Saline water, *Salinity, *Desalination, Water requirements, Water users, Water use, *Red River, Economic aspects.

The methodology used to determine the economic merit of investment for removal of salt pollution in the Red River is described. The primary points of evaluation include: existing water uses, existing water sources, future municipal water demands, future industrial water demands, alternative water sources to meet future demands, and finally, the cost of Red River water. The results of these evaluations show that the Red River chloride control project should be constructed and that the estimated benefit-to-cost ratio is 1.6 to 1. (Halterman-PTT)
W86-02275

PROCESS OF PROJECT PREPARATION,
Walker and Partners Ltd., Ottawa (Ontari).
B. Grover.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 269-285, 2 fig, 6 ref.

Descriptors: *Project planning, *Sanitation, *Water supply development, *Decision making, *Feasibility studies, Future planning, Evaluation, Planning, Financing, Management planning, Financial feasibility, Water supply, Projections, Benefits.

The basic factors involved in the preinvestment planning of water supply and sanitation development projects are reviewed. A brief report suffices to identify a possible project and commence the preinvestment planning. The prefeasibility study aims to select a preferred project for near term implementation after considering longer-term needs, existing system deficiencies and alternative system development. International financing agencies normally require general data on how the water supply and sanitation sector is organized throughout the country, and on how effectively services are currently provided and on national goals concerning water supply and sanitation services. The rationale for proceeding to develop a project must be explained carefully. Separate plans should be prepared for the phased development of water supply and sanitation systems to meet projected needs in the project area throughout the planning period. The prefeasibility stage should reach certain conclusions and recommend future actions, including the preparation of selected projects in a comprehensive feasibility study. The feasibility stage is the last stage before a project is approved and funds are committed. The feasibility report should provide data on the proposed project, institutional and financial aspects, and project impacts and justification. Resources for project preparation are discussed. Project approval usually depends on the consensus of several interest groups. (Geiger-PTT)
W86-02339

OPERATION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS,
Walker and Partners Ltd., Ottawa (Ontari).
For primary bibliographic entry see Field 5D.
W86-02341

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

EVOLUTION OF A COST SHARING POLICY FOR FEDERAL CHLORIDE PROJECTS,
Army Engineer Div. Southwestern, Dallas, TX.
H. G. Robinson, and R. R. De Bruin.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 23-32, 1 fig, 1 tab, 5 ref.

Descriptors: *Saline water, *Salinity, Irrigation, Water requirements, Water supply, Water use, Water users, Arkansas River, Kansas, Oklahoma, Arkansas, Red River, Texas, Brazos River Basin, Cost sharing, Economic aspects.

The 20-year evolution of the cost-sharing rationale of the control of chlorides from natural sources is discussed. The financing involves several levels of the Federal government and the particular states that are involved. The major factors that influence any cost-sharing rationale include precedents (sim larity of project to others with established co sharing policies), national objectives, state of t economy, recent laws or policies, and the logic the new cost apportionment proposal. Specific m ural sources of salt that are discussed include t Arkansas and Red Rivers and the Brazos Riv basin. The general cost-sharing rationale is summ rized as follows. From 1961-1963, 100% of chl ride control was paid for by the Federal Interst Water Quality Project. In following years, t federal government paid from zero to 75% costs. In 1977-1980, 100% of costs were paid non-federal government agencies. In recent yea the federal government has provided substanti reimbursements to non-federal agencies. (Halte man-PTT)
W86-02266

WATER SUPPLY AROUND THE WORLD--A PROPRIATE TECHNOLOGY,
North Carolina Univ. at Chapel Hill. Dept. Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W86-02325

COST-EFFECTIVE WATER SUPPLY AN SANITATION PROJECTS FOR DEVELOPIN COUNTRIES,
International Bank for Reconstruction and Deve opment, Washington, DC. Dept. of Transportatio and Water.
F. L. Golladay.
IN: Water Supply and Sanitation in Developi Countries, Ann Arbor Science, Ann Arbor, M 1982. p 221-249, 2 fig, 3 tab, 1 ref, 3 appen

Descriptors: *Cost analysis, *Cost-benefit analysi *Water supply development, *Sanitation, *Deve oping countries, Economic aspects, Project pla ning, Water supply, Costs, Econometrics, Ec nomic evaluation.

This chapter suggests how needs for water suppl and waste disposal can be met as sharply reduce costs. The economist is charged with the respons bility of cost-effectiveness and cost-benefit analys of development projects. The value of benefits generally difficult to quantify. The accounting costs is usually incomplete. The value attached inputs frequently bears little relationship to the social opportunity costs. Where surface water uncontaminated and continuous, it offers the lea costly option for water supply. Groundwater su plies are inexpensive when they can be drawn b hand with rope and bucket. The major issue urban water supply projects is the type of deliver system to be installed. Waterborne sewerage pr vides not only health and environmental benefit but very high consumer convenience. Examples least-cost analyses of water supply and sanitatio systems are presented. The initial choice of tec nology to improve sanitation should also refle the desire for future improvements. The purpose determining economic costs is to provide the bas for meaningful least-cost comparisons among alte natives. Unless substantial subsidies are feasibl low income consumers can afford only the chea est of the low-cost options. A government mig attach top priority for sanitation development areas where the burden of disease is greatest. Ap pendices dicuss the use of shadow pricing in co analysis, costs of alternative water supply and san tation service levels, and alternative service leve for urban water supply. (Geiger-PTT)
W86-02337

FINANCING WATER SUPPLY SYSTEMS,
North Carolina Univ. at Chapel Hill. Dept. Environmental Sciences and Engineering.
D. A. Okun.
IN: Water Supply and Sanitation in Developin Countries, Ann Arbor Science, Ann Arbor, M 1982. p 251-267, 6 fig, 10 ref.

Descriptors: *Economic aspects, *Water supply *Financing, *Water costs, *User charges, Cos analysis, Water supply development, Sanitation Developing countries, Project planning, Costs Economic evaluation.

Financing of a system of water supply by the user is needed to provide the user with a sense of the value of the system and help assure its proper operation and maintenance. The income will help defray at least the cost of operation and maintenance and provide funds for expansion of the system as needed. If local participation in financing is needed to assure success of a water supply project, then local initiative and collaboration in the planning and implementing of the project should also be included. Methods of collection of fees for water include residential metering, and metering at roadside standpost water supplies. Another less costly option that may delay metering is the use of flow restrictors or Fordillas. Water vending by individuals or by the government is often practiced in cities and villages not served by piped systems. Financing affects the design of water supply systems in terms of facility size and the availability of funds for capital and manpower in the face of massive needs. If a long-term and continuing investment in water supply and sanitation systems is to be assured for those curently being served and for the large percentage of the population not yet being served, financing systems need to provide sufficient funds, not only for payment of current operation and maintenance costs, but for repayment of capital costs. (Geiger-PTT)
W86-02338

6D. Water Demand

WATER USE IN OHIO, 1980,
Geological Survey, Columbus, OH. Water Resources Div.
M. Eberle, and J. A. McClure.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4024, 1984. 35 p, 5 fig, 7 tab, 28 ref.

Descriptors: *Water use, Industrial water, Thermal powerplants, Municipal water, Livestock, Rural areas, *Ohio.

An estimated 13,389 million gallons of water per day were used in Ohio in 1980, in four major categories of water use. Of this total, 12,645 Mgal/d (million gallons per day) were taken from surface-water sources whereas 744 Mgal/d was ground water. Totals for each category (in Mgal/d) were: thermoelectric power generation, 10,417; self-supplied manufacturing, 1,399; public water supplies, 1,432; and rural domestic and livestock, 41. Additional miscellaneous uses (irrigation, rural commercial, and non-manufacturing industrial) probably totaled about 300 Mgal/d. The five counties that led the state in total water use were: Jefferson, 2,620 Mgal/d; Lucas, 1,150 Mgal/d; Mahoning, 1.086 Mgal/d; Cuyahoga, 1,085 Mgal/d; and Lorain, 991 Mgal/d. These counties, in the same order, were the top five surface-water users. (USGS)
W86-01954

ESTIMATE OF SELF-SUPPLIED DOMESTIC WATER USE IN OKLAHOMA DURING 1980,
Geological Survey, Oklahoma City, OK. Water Resources Div.
C. D. Stoner.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4223, 1984. 20 p, 7 fig, 4 tab, 7 ref.

Descriptors: Water supply, *Water utilization, Domestic water, *Oklahoma, *Water use.

Reported or measured water-use data for the domestic self-supplied user were not available for the state of Oklahoma; therefore, estimates of water use within this classification were derived. The total self-supplied population in Oklahoma during 1980 was estimated at 343,615, which was 11.4 percent of the total 1980 State population. The rate of water use by this group was estimated to be 56 gallons per capita per day. For 1980, the estimated annual domestic self-supplied water use by county ranged from 10 to 1,180 acre-feet, with a total statewide use of 21,610 acre-feet. (USGS)
W86-02380

6E. Water Law and Institutions

OVERVIEW OF THE LEGAL, POLITICAL, AND SOCIAL IMPLICATIONS OF WASTEWATER TREATMENT THROUGH AQUACULTURE,
Denver Research Inst., CO.
For primary bibliographic entry see Field 5D.
W86-02068

EFFECTS OF FEDERAL REGULATIONS ON WATER TREATMENT PLANT DESIGN,
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5F.
W86-02189

WHAT IS THE MOST EFFECTIVE WATER POLICY FOR THE UNITED STATES: NATIONAL DEBATE TOPIC FOR HIGH SCHOOLS, 1985-1986,
Library of Congress, Washington, DC. Congressional Research Service.
Pursuant to Public Law 88-246, Senate, 99th Congress: 1st Session, Document No. 99-2, 1985. 957 p, 169 ref.

Descriptors: *Planning, *Water law, *Water policy, *Water supply, *Water quality, Federal jurisdiction, Water resources development, Water management, Institutional constraints, Water rights, Legal aspects, Water transfer, Wastewater treatment, Potable water, Drinking water.

Resource material for a national debate topic for high schools (1985-1986) consists of published papers, a bibliography, and guide to information sources, including government publications. The book is divided into chapters on background materials and the three debate propositions: (1) Resolved: that the federal government should implement a national system of priorities to control the allocation of all water in the United States, (2) Resolved: that the federal government should establish a comprehensive national policy to protect the quality of water in the United States, and (3) Resolved: that the federal government should establish a national policy to insure each United States resident an adequate supply of potable water for personal use. (Cassar-PTT)
W86-02218

LEGAL AND INSTITUTIONAL CONSTRAINTS TO SALINITY CONTROL,
Bureau of Reclamation, Provo, UT. Utah Projects Office
J. Franson, and M. Lopez.
IN: Salinity in Watercourses and Reservoirs, Butterworth Publishers, Boston. 1984. p 55-61, 6 ref.

Descriptors: *Salinity, *Saline water, Irrigation, Irrigation procedures, Water requirements, Irrigation requirements, Water supply, Water use, Water users, Colorado River, Colorado River Basin.

A variety of constraints to salinity control in the Colorado River are reviewed. General constraints that are discussed include the local perception that salinity control benefits only the lower Colorado Basin at the expense of the upper Basin, and, the perception by the federal government that the problem is regional and should be solved by the Basin states. Further constraints that are discussed include a lack of urgency at both the local and national level, and a lack of coordination in funding between the Bureau of Reclamation and the Soil Conservation Service. Possible options for slowing down the projected increases of salinity concentrations are discussed. They fall into three categories: prevent saline waters from entering the River, reduce salt pickup of waters entering the River, and provide extra water for dilution of salinity.
W86-02269

SALINITY BUBBLES AND OFFSETS: A CONCEPT PAPER,
Environmental Protection Agency, Denver, CO. Water Management Div.
For primary bibliographic entry see Field 5G.
W86-02271

WATER SUPPLY AND SANITATION IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 5F.
W86-02324

WATER SUPPLY AROUND THE WORLD--APPROPRIATE TECHNOLOGY,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W86-02325

REGIONALIZATION OF WATER SUPPLY AND SANITATION SERVICES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W86-02326

6F. Nonstructural Alternatives

EVALUATION OF COMMUNITIES FOR THE APPLICATION OF LIMITED-DETAIL STUDY METHODS FOR FLOOD-INSURANCE STUDIES,
Geological Survey, Reston, VA. Water Resources Div.
E. D. Cobb.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4098, 1985. 54 p, 3 fig, 3 tab.

Descriptors: *Floods, *Flood discharge, Flood plain management, *Flood profiles, *Flood routing, Maps, Insurance, *Flood insurance, Data collections, *Data program design, *Limited-detail flood-insurance studies, Historical floods, Depth-frequency studies, Evaluations.

The U.S. Geological Survey evaluated 2,349 communities in 1984 for the application of limited-detail flood-insurance study methods, that is, methods with a reduced effort and cost compared to the detailed studies. Limited-detail study methods were found to be appropriate for 1,705 communities, while detailed studies were appropriate for 62 communities and no studies were appropriate for 582 communities. The total length of streams for which limited-detail studies are recommended is 9,327 miles with a corresponding cost of $23,007,000. This results in average estimated costs for conducting limited-detail studies of $2,500 per mile of studied stream length. The purpose of the report is to document the limited-detail study methods and the results of the evaluation. (USGS)
W86-02373

6G. Ecologic Impact Of Water Development

APPEARANCE AND WATER QUALITY OF TURBIDITY PLUMES PRODUCED BY DREDGING IN TAMPA BAY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
C. R. Goodwin, and D. M. Michaelis.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Supply Paper 2192, 1984. 66 p, 47 fig, 20 tab, 41 ref.

Descriptors: *Estuaries, *Dredging, *Water quality, *Aerial photography, *Florida, Turbidity, Nutrients, Metals, Pesticides, *Tampa Bay, *Turbidity plumes.

Turbidity plumes in Tampa Bay, Florida, were photographed and sampled during ship-channel dredging operations from February 1977 to August 1978 to document plume appearance and water

quality. Color photographs depict plumes ranging in length from tens of meters to several kilometers with turbidity levels from less than 10 to 200,000 Nephelometric Turbidity Units. Sediment composition varied from 85 percent sand and shell to 60 percent silt and clay. Plumes from one hopper dredge and three cutterhead-pipeline dredges were investigated. Disposal methods included beach nourishment, stationary submerged discharge, oscillating surface discharge, and creation of emergent dikes using turbidity barrier containment. Tidal velocities ranged from zero to 0.60 meters per second. Primary turbidity plumes were created directly by dredging and disposal operations and secondary plumes were created indirectly by resuspension of previously deposited material. The most visible turbidity plumes resulted from surface discharge to unconfined disposal areas of material having relatively high sand content discharging during times of strong tidal currents. Changes were not detected in nutrient, metal, and pesticide concentrations in Tampa Bay due to dredging. Few long-term turbidity characteristics of Tampa Bay could be directly attributed to dredging operations. (USGS)
W86-01929

CHEMICAL QUALITY OF WATER AT 14 SITES NEAR KESTERSON NATIONAL WILDLIFE REFUGE, FRESNO AND MERGED COUNTIES, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-01959

PROJECTING LAND USE CHANGES ASSOCIATED WITH SMALL WATERSHED DEVELOPMENT,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
J. Kasal, and W. Crosswhite.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-149427, Price codes: A03 in paper copy, A01 in microfiche. ERS Staff Report No. AGES820330, April 1982. 47 p, 5 fig, 8 tab, append.

Descriptors: *Small watersheds, *Land use, *Projections, *Water resources development, *Statistical methods, Aerial photography, Markov process, Mathematical studies, Evaluation, Project planning.

This study determines if projected land use changes and their benefit estimates are biased in favor of project development. Both the base period land use estimates and the projected land use changes in a sample of 40 projects in two contrasting geographical regions were found to be reliable. When observed land use changes are measured from aerial photographs, the differences between projected and observed land use changes were not statistically significant. Four alternative land use projection techniques - aerial photography, trend analysis, cooperative river basin study procedures and the Markov process - did not improve upon the reliability of the U.S. Department of Agriculture Soil Conservation Service (SCS) land use projections. The SCS land use projection procedures for small watershed areas are set forth in the Economics Guide. Farm surveys are used to collect land use data for planning and evaluation of small watershed projects. The SCS land use projection procedures provide reliable measures of land use trends for estimating land use benefits due to project measures. (Geiger-PTT)
W86-01976

PATTERNS IN PREHISTORIC SETTLEMENT: EXAMINING THE DISTRIBUTION OF SITES IN A PORTION OF THE COLORADO RIVER VALLEY,
New World Research, Inc., Tucson, AZ.
Report of Investigations No.83-11, 1984. Compiled by John E. Keller, and L. Janice Campbell. Bureau of Reclamation, Amarillo, TX. 259 p, 64 fig, 23 tab, 6 app, 137 ref.

Descriptors: *Environmental effects, *Water resources development, *Archeology, Columbus Bend Dam, *Texas, Colorado River, Colorado Coastal Plains Project.

A cultural resources investigation of the proposed Columbus Bend Dam and Reservoir in Colorado and Fayette counties, Texas, revealed 96 sites. These were dominated by prehistoric lithic scatters. Lithic-ceramic scatters, stratified prehistoric sites, and historic sites were also identified. The work produced a predictive model of site location and interpretation of site data in light of cultural patterns and influences in settlement. (Cassar-PTT)
W86-01991

INDIAN LAND USE AND OCCUPANCY IN THE FRANKLIN D. ROOSEVELT LAKE AREA OF WASHINGTON STATE,
R. Bouchard, and D. Kennedy.
Colville Confederated Tribes, Nespelem, WA. June 1984. 456 p, 129 fig, 234 ref.

Descriptors: *Environmental effects, *History, *Land use, Indians, Franklin D. Roosevelt Lake, Washington, Columbia River.

Indian land use and occupancy were studied in Franklin D. Roosevelt Lake, Washington, the area along the Columia River between Grand Coulee Dam and the Canadian border. Elderly Indian informants and archives yielded 408 place names. For each place name are given the associated legends, meaning of the name, and activities. A comprehensive history of land utilization in Sanpoil, Spokane, Colville, and Lakes Indian territories traces events starting with the fur trading era. Information about hunting, fishing, plant food gathering, intergroup relations and territories is most abundant for the Sanpoil people. Little details are available for the Lakes and Colville peoples. However, some generalizations, common to all fishing-hunting-gathering people, can be made. (Cassar-PTT)
W86-01992

POTENTIAL CONSEQUENCES OF REJECT STREAM REPLACEMENT PROJECTS ON AQUATIC, TERRESTRIAL, AND RECREATION RESOURCES: VOLUME II, AQUATIC RESOURCES,
Engineering-Science, Inc., Arcadia, CA.
U.S. Bureau of Reclamation, Boulder City, NV. February 1980. 219 p, 33 fig, 21 tab, 4 append.

Descriptors: *Environmental effects, *Wildlife, *Fish, *Aquatic habitats, Yuma Desalting Plant, Butler Valley, Arizona, Imperial Valley, California, Alamo River, Salton Sea, All-American Canal, Santa Clara Slough, Aquatic plants, Aquatic animals, Aquatic life, Habitats, Marshes, Salt marshes, Canals, Rivers, Invertebrates, Streams, Brines, Desalination.

Effects on aquatic resources are discussed for several proposed projects for replacing the 44,000 acre-feet/year of brine flow rejected from the Yuma Desalting Plant. Proposed locations for these projects are the Imperial Valley, California, or Butler Valley, Arizona. Water systems affected by the projects include the All-American Canal, Alamo River, Salton Sea, Santa Clara Slough, and Butler Valley. For each system the following were determined: channel features, hydrology, water quality, substrates, underwater cover, and aquatic life (fish, algae, macrophytes, invertebrates, amphibians, and reptiles). The All-American Canal, impacted only in the 43.5-mile reach from Pilot Knob to East Highline Canal, supports a large gamefish population which is not widely fished. The Alamo River is not a good fishery, because of a small fish populaiton and concern over bacterial and pesticide contamination. The saline Salton Sea at Wister has only three macroinvertebrates (pile worms, barnacles, and amphipods) and three gamefish species. The Santa Clara Slough, a small salt marsh, contains 14 species of salt water fish and a variety of fish-eating birds. The Butler Valley in Arizona has no perennial streams or standing waters, only desert washes. Groundwater is abundant at depths of 100-500 feet. (Cassar-PTT)
W86-01994

CLASS III SURVEY OF THE TUCSON AQUEDUCT PHASE A CORRIDOR, CENTRAL ARIZONA PROJECT: AN INTENSIVE ARCHAEOLOGICAL SURVEY IN THE LOWER SANTA CRUZ RIVER BASIN, PICACHO RESERVOIR TO RILLITO, ARIZONA,
Arizona State Museum, Tucson. Cultural Resource Management Div.
Archaeological Series 165, January 1984. Compiled by Jon S. Czaplicki. 286 p, 136 fig, 64 tab, 201 ref, 5 append. 0-07-30-X0091.

Descriptors: *Environmental effects, *Archeology, Water resources development, Right-of-way, Aqueducts, *Central Arizona Project, *Tucson Aqueduct, *Arizona, Aqueducts, Santa Cruz River.

A Class III intensive survey of 42 miles (about 9753 acres) of Phase A of the Tucson Aqueduct, Central Arizona Project, was conducted between June 7 and October 15, 1982. Seventy-eight prehistoric and eight historic sites were recorded. Twenty-one of the prehistoric sites are Archaic sites or are sites with an Archaic component. These sites, in addition to numerous isolated projectile points, indicate a potentially extensive Archaic occupation of the study area. The 57 Hohokam sites include three Classic period communities, one in each reach and each one apparently centered on a platform mound complex. The platform mound on Brady Wash in Reach 1 lies just outside the aqueduct right-of-way. Several Preclassic sites were also identified in Reaches 1 and 2, including a reservoir in Reach 2. The 1982 survey identified a previously undocumented Archaic occupation and a much more extensive Preclassic and Classic Hohokam occupation in the Lower Santa Cruz River Basin north of Tucson and south of Florence, Arizona. This area had received relatively little attention by archaeologists until the investigation carried out as a result of construction of the Tuscon Aqueduct. (Author)
W86-01995

POTENTIAL CONSEQUENCES OF REJECT STREAM REPLACEMENT PROJECTS ON AQUATIC, TERRESTRIAL, AND RECREATION RESOURCES: VOLUME III, TERRESTRIAL RESOURCES.
Engineering-Science, Inc., Arcadia, CA.
U.S. Bureau of Reclamation. Boulder City, NV. February 1980. 329 p, 23 fig, 15 tab, 4 append.

Descriptors: *Environmental effects, *Vegetation, *Wildlife, Habitats, Mammals, Birds, Reptiles, Amphibians, Plant populations, Yuma Desalting Plant, Butler Valley, *Arizona, Imperial Valley, *California, Alamo River, Salton Sea, All-American Deserts, Arid lands, Brines, Desalination.

Effects on terrestrial resources are discussed for several proposed projects for replacing the 44,000 acre-feet/year of brine flow rejected from the Yuma Desalting Plant. Proposed locations for these projects are the Imperial Valley, California, or Butler Valley, Arizona. Vegetation and wildlife characteristics are reported for both areas. The Imperial Valley has nine types of communities from wetlands and river riparian to cresote bush and sand dunes. The animal population (54 species of mammals, 297 species of birds, 42 species of reptiles and amphibians) features several special interest birds and reptiles. The major concern is the rare black rail and the endangered Yuma clapper rail, which would be severely threatened by the wetlands elimination. The mammal population is comprised of few game mammals but many furbearers and rodents. Waterfowl are abundant. Butler Valley is a sparsely settled, productive desert community is the most attractive wildlife habitat. Five endangered or threatened wildlife species are found in the Butler Valley: peregrine falcon, desert bighorn, zone-tailed hawk, desert tortoise, and Gila monster. Ten species of blue list birds (not endangered in the study area, but scarce in other areas of the U.S.) live in this valley. (Cassar-PTT)
W86-02011

FLUCTUATING WATER LEVELS IN RESERVOIRS; AN ANNOTATED BIBLIOGRAPHY

ON ENVIRONMENTAL EFFECTS AND MANAGEMENT FOR FISHERIES,
Fish and Wildlife Service, Fayetteville, AR.
For primary bibliographic entry see Field 10C.
W86-02033

WATER QUALITY, MACROINVERTEBRATES, AND FISHERIES IN TAILWATERS AND RELATED STREAMS: AN ANNOTATED BIBLIOGRAPHY,
Fish and Wildlife Service, Bowling Green, KY. East Central Reservoir Investigations.
For primary bibliographic entry see Field 10C.
W86-02035

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS, REPORT 2: FIRST YEAR POSTSTOCKING RESULTS,
Florida Game and Fresh Water Fish Commission, Orlando.
S. Hardin, R. Land, G. Morse, and M. Spelman.
Volume II: The Fish, Mammals, and Waterfowl of Lake Conway, Florida, Technical Report A-78-2, February 1982. Report 2 of a Series. Army Engineer Waterways Experiment Station, Vicksburg, MS. 70 p, 15 fig, 9 tab, 55 ref, append. DACW39-76-C-0081.

Descriptors: *Aquatic weed control, *Aquatic weeds, *Biological control, White amur, Fish diets, Waterfowl, Aquatic mammals, Lake Conway, Florida.

Fish, waterfowl and wading birds, and aquatic mammal populations on Lake Conway, Orange County, Florida were surveyed for one year after the introduction of the herbivorous fish, white amur (Ctenopharyngodon idella). Fish populations were sampled by Wegener ring, seine, gill nets and electrofishing. Standing crop estimates were made with blocknet and rotenone collections. The sportfishery was measured by creel surveys. Waterfowl were observed and counted from an airboat, and collected by shotgun. Aquatic mammals were collected by a variety of traps. Low water levels reduced littoral zone area, which lead to stunted panfish and poorer condition of largemouth bass. Vegetated samples supported more diverse fish populations than beach sites. White amur and migratory waterfowl consumed the same plant foods; continued reduction of submerged plants by white amur may adversely affect overwintering waterfowl populations. Aquatic mammals were influenced by removal of vegetation due to shoreline development. (Author's modified abstract)
W86-02037

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS, REPORT 2: FIRST YEAR POSTSTOCKING RESULTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
D. L. Crisman, and F. M. Kooijman.
Volume III: The Plankton and Benthos of Lake Conway, Florida, Technical Report A-78-2, November 1981. Report 2 of a Series. Army Engineer Waterways Experiment Station, Vicksburg, MS. 1 p, 28 fig, 4 tab, 22 ref.

Descriptors: *Aquatic weed control, *Aquatic weeds, *Biological controls, White amur, Phytoplankton, Zooplankton, Lake Conway, Florida, Benthic fauna.

After the stocking of Lake Conway, Florida, with white amur to control aquatic vegetation, studies of the effects on plankton, benthos and zooplankton were conducted. Major fluctuations in plankton, benthos and zooplankton communities confounded the determination of the effects of white amur introduction. Further long-term studies are needed to determine the effectiveness and overall impact of introducing white amur for macrophyte control. The results are based on analyses of data on physical-chemical parameters, plant pigments, and abundance and species composition of phytoplankton, zooplankton and benthic macroinvertebrates. (Halterman-PTT)
W86-02038

ASSESSING AND MANAGING EFFECTS OF REDUCED FRESHWATER INFLOW TO TWO TEXAS ESTUARIES,
National Coastal Ecosystems Team, Slidell, LA.
N. A. Funicelli.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 435-446, 2 tab, 7 ref.

Descriptors: *Enviromental effects, *Estuaries, *Management, *Filtration, Coastal zone management, Wildlife, Fish, Nutrients, Marshes, Floods, Nueces River, Corpus Christi Bay, Matagorda Bay, Rivers, Saline water, Aquatic habitats, Habitats, Organic carbon, Phosphorus, Nitrogen, Deltas, Wastewater disposal, *Texas.

While a major objective of coastal zone management plans is to maintain the value and use of estuaries, decisions affecting inflow, a critical component of estuaries, are often based on considerations of water use inland. The functions of estuaries as filters for inland based signals is often ignored. For effective manaagementof both inlandwater resources and estuarine freshwater inflow, methods for assessing the actual effects of inland perturbations are needed. Because no single method exists, the U.S. Fish and Wildlife Service used a set of evaluative methods to assess the effects of reduce freshwater inflow on estuaries in Nueces-Corpus Christi and Matagorda Bays and to develop management plans for ensuring fish and wildlife productivity. The set included (1) studying the effects of environmental changes on key species, (2) regression analysis between inflow and fishery harvest data, (3) compilation and analysis of a nutrient budget, and (4) comparison of historical and projected deltaic marsh inundations. Proposed management plans to address the findings of these assessment methods involved the release of freshwater during spring and low inflow, the rerouting of selected wastewater to the river delta, and the diversion of in-channel water to inundate deltaic marshes. These plans all depend upon compromises between inland and coastal needs. (Author)
W86-02090

DETERIORATION OF COASTAL ENVIRONMENTS IN THE MISSISSIPPI DELTAIC PLAIN: OPTIONS FOR MANAGEMENT,
Louisiana Universities Marine Consortium, Chauvin.
D. F. Boesch, J. W. Day, and R. E. Turner.
IN: The Estuary as a Filter, Academic Press, Orlando, FL. 1984. p 447-466, 2 fig, 1 tab, 34 ref. 14-16-0009-81-1016.

Descriptors: *Environmental effects, *Estuaries, *Deltas, *Management, *Mississippi River, *Louisiana, Channeling, Wetlands, Marshes, Canals, Dredging, Coastal zone management, Aquatic habitats, Habitats, Saline water, Water diversion, Sediment transport.

Coastal environments in the Mississippi Deltaic Plain of southeastern Louisiana are undergoing rapid change as a result of natural decay of Mississippi delta lobes, channelization of river flow, and dredging activities. As a result, over 100 sq km per year of coastal wetlands are converted to open water or uplands--85% of the total U.S. loss rate. Of the options available to reduce the deterioration of coastal wetlands, management of new delta accretion and regulatory control and rehabilitation of channelized wetlands are likely the most effective. Attempts to stabilize coastal barriers should also be made because of the potential for very rapid erosion in their absence. Controlled diversions of the river above the active deltas will be limited in capacity by the presence of populated areas and roads are unlikely to contribute significantly to new wetland accretion. (Author)
W86-02091

IMPACT OF RESERVOIRS ON SEASONAL AND HISTORICAL SALINITY OF THE COLORADO RIVER,
Bureau of Reclamation, Salt Lake City, UT.
For primary bibliographic entry see Field 5B.
W86-02279

HISTORICAL TRENDS IN CONCENTRATION AND LOAD OF MAJOR IONS IN THE COLORADO RIVER SYSTEMS,
Bureau of Reclamation, Denver, CO.
For primary bibliographic entry see Field 5B.
W86-02280

FISH AND WILDLIFE MITIGATION PROGRAM FOR THE COLORADO RIVER BASIN SALINITY CONTROL PROJECT - A CASE HISTORY,
Bureau of Reclamation, Boulder City, NV. Lower Colorado Region.
For primary bibliographic entry see Field 5G.
W86-02312

POTENTIAL FOR INTRODUCTION OF THREE SPECIES OF NONNATIVE FISHES INTO CENTRAL ARIZONA VIA THE CENTRAL ARIZONA PROJECT - A LITERATURE REVIEW AND ANALYSIS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
S. J. Grabowski, S. D. Hiebert, and D. M. Lieberman.
Report REC-ERC-84-7, June 1984. 124 p, 8 fig, 48 tab, 316 ref.

Descriptors: *Environmental impact statement, *Tilapia, *Bass, Environmental effects, *Pumping plants, *Food chains, Fish, Fish populations, Water resources development, Water quality, Ecological effects, Fisheries, Rivers, Lakes, Eagles, Birds.

During operation of the Central Arizona Project (CAP) which is designed to deliver allocated Colorado River water to central and southern Arizona, fish will be pumped from Lake Havasu to central Arizona receiving waters. The life history characteristics of three fish species, water quality aspects of CAP source and receiving waters, the existing fisheries of CAP sources and receiving waters, physical features of pumping plants, and some life history phenomena of the southern bald eagle are documented. Striped bass and blue tilapia may have an adverse impact on the existing fishery of Lake Pleasant. These two species and the white bass are suspected of having an adverse impact on the ecology of the Salt and Verde Rivers. If blue tilapia enter Lake Pleasant, they will likely survive and reproduce while striped bass will be much less likely to reproduce. Recruitment by introduction would continue to occur. If these fish become established and their numbers are not controlled by predators or environmental pressures, they could have an impact on the fish food base of the southern bald eagles along these rivers. (Geiger-PTT)
W86-02322

MORMON CARTER CLASS III CULTURAL RESOURCE SURVEY,
Bureau of Reclamation, Denver, CO. Lower Missouri Region.
S. R. Bradley, and M. Musitelli.
September 1984. 103 p, 53 fig, 28 ref, 2 append.

Descriptors: *Environmental effects, *Archeology, Mormon Carter Transmission Line, Fryingpan River, Colorado, Water resources development, Water transfer.

The Lower Missouri Region of the Bureau of Reclamation conducted a Class III cultural resources survey of the Mormon Carter Transmission Line in the North Fork Fryingpan River drainage, Pitkin County, Colorado. Four prehistoric sites and three historic sites were recorded during the survey. Manifestations of cultural behavior resulting from a lifeway of prehistoric, seasonal resource exploitation are contrasted to the manifestation resulting from a historic sedentary adaptation. The presence of a possible Rose Spring Corner Notched projectile point indicates human utilization of the North Fork drainage from at least

300 A.D. to the present. Five sites are recommended for avoidance or mitigation. The possible presence of subsurface deposits at these sites suggests eligibility to the National Register of Historic Places. (Author)
W86-02323

7. RESOURCES DATA

7A. Network Design

EVALUATION OF THE SURFACE-WATER DATA NETWORK, SUWANNEE RIVER BASIN, FLORIDA, 1982,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. P. Rumenik, and J. E. Coffin.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4245, 1984. 22 p, 5 fig, 2 tab, 17 ref.

Descriptors: *Surface waters, *Gaging stations, *Water management, Flow characteristics, River forecasting, Flood profiles, Low flow, *Florida, *Suwannee River basin, Surface-water data network.

In the 9,950 square mile area of the Suwannee River basin in Florida and Georgia, a network of 33 surface-water gaging stations operated for different periods of time from 1927 to 1982 was evaluated for its capability to provide program information for floodplain mapping, floodplain management, forecasting of flow extremes, and defining the impact of changes in land use on surface-water quantity and quality. Gaging stations are classified based on the type of data and number of years record as current use, long-term trend, and planning and design. Goals are established for each classification. Suggestions for program revisions include establishing crest-stage gages for high-flow and flood-profile data, defining and establishing a low-flow network, and establishing two and discontinuing one daily discharge station. (USGS)
W86-01936

GROUND-WATER-QUALITY MONITORING NETWORK DESIGN FOR THE SAN JOAQUIN VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
W. E. Templin.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Inbvestigations Report 83-4080, 1984. 133 p, 19 pl, 7 fig, 6 tab, 131 ref.

Descriptors: Groundwater, Water quality, *Network design, Geology, Land use, *Water pollution sources, *Nonpoint pollution sources, Groundwater levels, *Groundwater quality, *Groundwater pollution, *California, Point sources, San Joaquin Basin, Tulare Basin, Sacramento-San Joaquin Delta, Pesticides (DBCP), Pesticides, Regional network design.

This report proposes ideal and actual ground-water-quality monitoring networks for the San Joaquin Valley basin, California. The report outlines an ideal network, comprising several subnetworks, to provide direction in development of actual networks composed of wells currently (1981) known to be monitored. The ideal network serves as a basis for future expansion of the actual networks as more wells are included in the inventory of active monitoring networks. The managment objectives of these networks are to develop a general baseline of ground-water quality, to identify trends in ground-water quality, and to identify sources of contamination. The networks are based on an information structure that includes land use, surface and subsurface geology, ground-water levels, surface- and ground-water quality, possible sources of contamination, and active ground-water-quality monitoring networks. Development of the categories and subcategories of network objectives, which are needed to describe the quality of ground water in the basin, make clear the inadequacy of the currently operated networks. The expansion of ground-water-quality monitoring in the San Joaquin Valley, therefore, would be necessary to approximate the objectives of the ideal network. (USGS)
W86-01953

COST-EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY STREAM-GAGING PROGRAM IN ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
M. E. Darling, and T. E. Lamb.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4084, 1984. 91 p 10 fig, 13 tab, 23 ref.

Descriptors: *Surface water records, *Statistical analysis, Gaging, Gaging station, Network, Streamflow, *Stream gaging, *Arkansas, *Cost-effectiveness.

This report documents the results of the cost-effectiveness of the stream-gaging program in Arkansas. Data uses and funding sources were identified for the daily-discharge stations. All daily-discharge stations were found to be in one or more data use categories, and none were candidates for alternate methods which would result in discontinuation or conversion to a partial record station. The cost for operation of daily-discharge stations and routing costs to partial record stations, crest gages, pollution control stations as well as seven recording ground-water stations was evaluated in the Kalman-Filtering Cost-Effective Resource allocation (K-CERA) analysis. This operation under current practices requires a budget of $292,150. The average standard error of estimate of streamflow record for the Arkansas District was analyzed at 33 percent.
W86-01961

ENVIRONMENTAL 'TERMITE' INSPECTIONS,
For primary bibliographic entry see Field 5A.
W86-02223

ANNUAL AVERAGE CLIMATIC MAPS OF THE UNITED STATES,
National Climatic Data Center, Asheville, NC.
Environmental Information Summaries, C-21, September 1983. 10 p, 4 ref.

Descriptors: *Mapping, *Maps, *Climatology, *Meteorological data collections, *United States, Hydrologic maps, Precipitation, Relative humidity, Humidity, Solar radiation, Corrosion control, Data collections, Weather data collections, Dewpoint, Thunderstorms.

Several annual average climatic maps of the United States prepared by the National Climatic Data Center are presented. The maps may be applied to areas of allergy studies, corrosion protection requirement determinations, agriculture, and general climatology. Average annual map presentations in this edition are: temperature, 1941-1970; total precipitation (water equivalent), 1941-1970; relative humidity, generally 1948-1977; dew point temperature, generally 1946-1965; annual average daily global solar radiation on a south facing surface, generally 1953-1975; mean annual number of thunderstorms, generally 1948-1977; and normal annual heating degree days (contiguous United States and Alaska), generally 1951-1980. These climatic maps reflect average atmospheric conditions that occur over periods of years. Often, observed conditions for any given year will differ significantly from those indicated in the analyses. Caution should be used in interpolating on these generalized maps as sharp changes may occur in short distances, particularly in mountainous areas, due to differences in altitude, slope of terrain, type of soil, vegetation cover, bodies of water, air drainage, urban heat effects and other effects. Upon examination of mapped data, sulfur oxide emission densities were found to be correlated with corrosion potential. (Geiger-PTT)
W86-02321

ILLINOIS GROUND-WATER OBSERVATIO NETWORK - A PRELIMINARY PLANNIN DOCUMENT,
Geological Survey, Urbana, IL. Water Resourc Div.
L. R. Frost, M. O'Hearn, J. P. Gibb, and M. G. Sherrill.
Available from OFSS, USGS, Box 25425 Lak wood, CO 80225. USGS Open-File Report 84-58 1984. 37 p, 11 fig, 1 tab, 28 ref.

Descriptors: *Groundwater, *Geohydrolog units, Groundwater levels, Water quality, Groun water reservoirs, Network design, Networks, Da storage and retrieval, *Illinois, *Groundwat monitoring, Data management.

Water-level and water-quality networks in Illino were evaluated to determine the adequacy a completeness of available data bases. Groun water data in present data bases are inadequate provide information on ground-water quality a water levels in large areas of Illinois and in t major geohydrologic units underlying Illinois a surrounding areas. Data-management needs ind cate that a new data base is desirable and could developed by use of carefully selected availab data and new data. Types of data needed to defi ground-water quality and water levels in selecte geohydrologic units were tentatively identifie They include data on concentrations of organ chemicals related to activities of man, and conce trations of inorganic chemicals which relate eith to man's activities or to the chemical compositio of the source aquifer. Water-level data are neede which can be used to describe short- and long-ter stresses on the ground-water resources of Illinoi Establishment of priorities for data collection h been deferred until existing hydrologic data fil can be stored for usable data and until input fro other local, State, and Federal agencies can b solicited and compiled. (USGS)
W86-02355

EVALUATION OF THE CREST-STAGE GAG PROGRAM IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water R sources Div.
R. A. Herbert, D. D. Carlson, and G. J. Wiche.
Available from OFSS, USGS, Box 25425, Lak wood, CO 80225. USGS Water-Resources Invest gation Report 84-4204, 1985. 24 p, 11 fig, 9 tab, ref.

Descriptors: *Network analysis, *Network desig Crest gages, Annual runoff, Peak flow, Desig floods, Index stations, Regression analysis, *Floo frequency, *Flood recurrence interval, Floo peak, Annual-peak discharge, Crest-stage gage Flood-frequency equations, *Louisiana, Pine Hil Region.

The crest-stage gage program in Louisiana w evaluated to determine if the data were adequat for use in developing regional flood-frequenc equations and to determine if any crest-stage gag could be discontinued. An abundance of data many crest-stage stations and a lack of data fo urban area and flat-slope areas indicated a need fo a shift in the number, type, and locations of gage Extensive correlations and comparisons of annu peak flows and watershed characteristics of 96 sit resulted in a reduced network of 25 stations th could potentially be used as index sites. The ade quacy of the reduced network for developmen and verification of regional flood-frequency equ tions was tested by comparing a set of region flood-frequency equations developed using da from the full network with a set developed usin data from the reduced network. The results ind cate that the crest-stage gage network can be re duced to 25 stations and still provide adequat information for future flood-frequency analyse (USGS)
W86-02399

PRAGMATIC APPROACH TO EVALUATING A MULTIPURPOSE STREAM-GAGING NET WORK,

eological Survey, Lakewood, CO. Water Re-
urces Div.
. L. Wahl, and J. R. Crippen.
vailable from OFSS, USGS, Box 25425, Lake-
ood, CO 80225. USGS Water Resources Investi-
ations Report 84-4228, 1984. 13 p, 1 fig, 2 tab, 6
f.

escriptors: *Network design, *Gaging stations,
treamflow, *Streamflow measurement, *Multi-
urpose networks, California.

method for evaluating the relative worth of
dividual streamflow gaging stations in a multipu-
se network is presented. Each individual gaging
ation in the network is evaluated on the basis of
lected rating factors. The factors relate to the
ed for information at the gaging stations, accura-
of data, economic aspects of operation, and
efulness of data as a basis for estimates at un-
ged sites. The total score for the various factors
ovides a convenient basis for comparing relative
portance of individual gaging stations. The
ting-factor method is both flexible and definitive,
t the point values that are assigned for each
ting factor are somewhat subjective. A table of
e point values and guidelines for assigning those
lues is presented. (USGS)
86-02417

3. Data Acquisition

**ATER-RESOURCES INVESTIGATIONS OF
IE U.S. GEOLOGICAL SURVEY IN WYO-
ING, FISCAL YEAR 1984,**
eological Survey, Cheyenne, WY. Water Re-
urces Div.
L. Green.
ailable from OFSS, USGS Box 25425 Lake-
od, CO 80225. USGS Open-File Report 84-622,
84. 112 p, 4 fig, 5 tab, 6 ref.

escriptors: *Water resources, *Hydrologic data,
Wyoming, Streamflow, Sediment load, Water
ality, Groundwater, Water supply, Environmen-
effects, Oil shale, *Coal regions.

is report contains lists and location maps of
eamflow and reservoir stations, crest-stage par-
-record stations, water-quality stations, sedi-
nt stations, and ground-water observation wells
t are currently being operated. Water-resources
raisal projects in Wyoming are also described,
luding many that are related to development of
rgy resources. The general locations of the
jects are shown on maps. The U.S. Geological
rvey is striving to coordinate its water-resources
estigations with those of other agencies. This
ort is one phase of that coordination effort, and
ves as an annual progress report to cooperators
the public. (USGS)
6-01926

**RELINE-ROTARY AIR CORING OF THE
NDELIER TUFF, LOS ALAMOS, NEW
EXICO,**
ological Survey, Lakewood, CO. Water Re-
rces Div.
E. Teasdale, and R. R. Pemberton.
ailable from OFSS, USGS, Box 25425 Lake-
od, CO 80225. USGS Water-Resources Investi-
ons Report 84-4176, 1984. 9 p, 4 fig, 3 ref.

criptors: Drilling, *Coring, *Air-rotary drill-
Disturbed geologic samples, Undisturbed geo-
c samples, Sampling, *Wireline coring, Core-
nodifications.

s paper describes experiments using wireline-
ry air-coring techniques conducted in the Ban-
er Tuff using a modified standard wireline
e-barrel system. The modified equipment was
d to collect uncontaminated cores of unconsoli-
ed ash and indurated tuff at Los Alamos, New
tico. Core recovery obtained from the 210-foot
p test hole was about 92 percent. A standard
-size, triple-tube wireline core barrel (designed
the passage of liquid drilling fluids) was modi-
for air coring as follows: (1) Air passages were
ed in the latch body part of the head assembly;
(2) the inside dimension of the outer core barrel tube was machined and honed to provide greater clearance between the inner and outer barrels; (3) oversized reaming devices were added to the outer core barrel and the coring bit to allow more clearance for air and cuttings return; (4) the eight discharge ports in the coring bit were enlarged. To control airborne-dust pollution, a dust-and-cuttings discharge subassembly, designed and built by project personnel, was used. (USGS)
W86-01934

ANNUAL SUSPENDED-SEDIMENT LOADS IN THE GREEN RIVER AT GREEN RIVER, UTAH, 1930-82,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-01935

THUDERSTORMS: A SOCIAL, SCIENTIFIC, AND TECHNOLOGICAL DOCUMENTARY. VOLUME 3: INSTRUMENTS AND TECHNIQUES FOR THUNDERSTORM OBSERVATION AND ANALYSIS.
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 2B.
W86-02003

STATION NETWORKS FOR STORM OBSERVATION,
National Weather Service, Sterling, VA. Test and Evaluation Div.
K. E. Wilk, and S. L. Barnes.
IN: Thunderstorms: A Social, Scientific, and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation and Analysis, April 1982. p 1-31, 24 fig, 2 tab, 47 ref.

Descriptors: *Thunderstorms, *Meteorological data collections, *Radar, *Networks, *Data acquisition, Network design, Data collections, Weather data collections, Remote sensing, Reviews, Storms, Computers.

This chapter reviews the development of mesometeorological research networks and their instrumentation, and outlines some modern methods for data acquisition and analysis. The Thunderstorm Project in the 1940's was the first major national effort to collect data on thunderstorms. In 1955, the U.S. Army Signal Corps sponsored a reanalysis of the Thunderstorm Project and the data collection network was expanded. In the 1950's, the National Severe Storms Project (NSSP) was initiated within the U.S. Weather Bureau. In the early 1960's, the Air Force Air Weather Service and the Weather Bureau expanded their jointly operated Severe Local Storms Forecast Center to anticipate squall line development. Rapid improvement in research radars in the mid-1960's pointed the way to continuous, quantitative observations of storm development. By 1975, several low-cost devices became available to provide telemetry of analog data from remote sites to a central facility. By 1981, semiautomatic and automatic archiving and retrieval of meteorological data sensed at surface stations had become a standard practice. The objective map analysis method, a computerized method for analysis of spatially distributed time series observations, is described. The method is applied to surface, and upper-air data collected at an NSSP laboratory in central Oklahoma. (Geiger-PTT)
W86-02004

OBSERVATIONS FROM INSTRUMENTED AIRCRAFT,
National Oceanic and Atmospheric Administration, Boulder, CO. Weather Modification Program Office.
J. McCarthy, and D. L. Veal.
IN: Thunderstorms: A Social, Scientific, and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation and Analysis, April 1982. p 47-76, 18 fig, 1 tab, 43 ref.

Descriptors: *Thunderstorms, *Radar, *Aircraft, *Aerial photography, *Meteorological data collections, Remote sensing, Lightning, Storms, Computers, Data acquisition, Storms, Weather data collections, Data collections.

Several major aircraft facilities exist which devote part of their efforts towards understanding the thunderstorm. Aircraft can serve as a direct in situ probe of thunderstorms whereas radar is indirect. Sensors that can be mounted on the aircraft are those that measure temperature, humidity, pressure, and air velocities. Observations of the cloud droplet spectrum are made by impactor sampling, optical devices, and electrostatic disdrometers. Liquid water content is calculated by summation of drop size spectrum or by direct bulk measurement techniques using evaporators, optical flow meters, transmissometers, microwave radiometers, paper tapes, synthetic filaments, and hot-wire total water indicators. Raindrop-sized hydrometeors can be measured by foil impaction, optical devices and momentum sensing. Ice crystals are collected by Formvar replication, on oil-coated slides, or are studied by optical techniques. Airborne radar can provide the aircraft crew with immediate thunderstorm data. Airborne computer-directed data systems are usually designed to operate for data acquisition, self-check or preflight-postflight program, and data processing. Chaff from aircraft has been used for radar jamming and lightning suppression. Examples are presented of cases where instrumented aircraft data have been combined with other direct and remote sensors to yield valuable data on thunderstorms. (Geiger-PTT)
W86-02005

PHOTOGRAMMETRY OF THUNDERSTORMS,
National Oceanic and Atmospheric Administration, Boulder, CO. Weather Modification Program Office.
R. L. Holle.
IN: Thunderstorms: A Social, Scientific, and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation and Analysis, April 1982. p 77-98, 10 fig, 29 ref.

Descriptors: *Thunderstorms, *Clouds, *Photogrammetry, *Aerial photography, *Meteorological data collections, Photography, Data collections, Weather data collections, Storms, Tornadoes, Aircraft, Data acquisition.

Photogrammetry of every transient feature in thunderstorms is possible, but can be tedious. Mathematical equations which are used in conjunction with photogrammetry for determining cloud features are given. The simplest photographs of clouds are still photos taken by hand-held cameras. The next simplest system is the time-lapse movie camera which is usually focused on developing cloud systems. Panoramic photographs of the sky at fixed intervals provide benchmarks of cloud evolution in every direction from a single location. Multiple time-lapse camera photography of thunderstorms can be taken from either one or several locations with cameras usually unattended. Stereoscopic photographs afford a qualitative distance to clouds without any analysis. Analysis of airborne photos is more difficult than for those taken at ground level. Cloud maps can be developed from aircraft photos with the aid of lines drawn to connect the flight track to specific clouds when they are perpendicular to the side cameras and when they are at the azimuths corresponding to their entering, or leaving the side camera's view. Techniques for measuring widths and heights of clouds, and techniques for obtaining pictures from above thunderstorms are also discussed. (Geiger-PTT)
W86-02006

OBSERVATION AND MEASUREMENT OF HAILFALL,
National Center for Atmospheric Research, Boulder, CO. Convective Storms Div.
G. M. Morgan.
IN: Thunderstorms: A Social, Scientific, and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation

and Analysis, April 1982. p 149-180, 15 fig, 3 tab, 70 ref.

Descriptors: *Hail, *Networks, *Measuring instruments, *Remote sensing, *Weather data collections, Thunderstorms, Network design, Precipitation, Data acquisition, Radar, Meteorological data collections, Data collections, Tornadoes.

Techniques for measuring hailfall have undergone rapid improvements in the past 25 or 30 years through the introduction of simple but effective instruments in well-designed networks. The wind that accompanies hail has a strong influence on crop damage because it can impart a velocity component to the hailstone several times that acquired through free fall alone. For some purposes, volunteer observer networks of hailfall which were introduced 100 yr ago, are still useful today. Types of hail measuring or recording instruments in use today include the hailpad, hailcube, geophone hail gage, Illinois State Water Survey hail gage, hail-rain separator, time-resolving hail recorder, hailstone spectrometer, chilled-kerosene hailstone freezer, electro-optical hail recorder, hailstone sensor, and remote-sensing devices (radar). In developing hailfall observation networks, the ratio between the area of the hailstreak and the area represented by one grid point should be obtained for a sample of hailstreaks that represent the range and distribution of hailstreaks to be expected in the network. The size of the network determines the number of study events available each year and the number of instruments required to monitor them. (Geiger-PTT)
W86-02007

WEATHER RADAR,
National Severe Storms Lab., Norman, OK.
R. J. Doviak, D. Sirmans, and D. Zrnic.
IN: Thunderstorms: A Social, Scientific, and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation and Analysis, April 1982. p 181-239, 24 fig, 92 ref.

Descriptors: *Radar, *Remote sensing, *Data acquisition, *Meteorological data collections, *Measuring instruments, Data collections, Weather data collections, Tornadoes, Storms, Cyclones.

A foundation of weather radar principles is given and related to the target's meteorological properties. Subjects such as light scattering properties of hydrometeors and extracting a target's properties from its echoes are reviewed. Radar parameters and echo power are related to the weights given to a hydrometeoric target's backscatter cross section. The radar signal path starting from the transmitter is followed through the antenna, along the beam to the target, and return to the receiver, highlighting along the way the important signal properties. The pulsed Doppler radar is discussed and a discrete target to develop radar principles and the radar equation are considered. The theory for conventional non-Doppler radar is also included. These principles are then extended to the more complex weather target, which is a conglomerate of discrete targets producing a continuous stream of echoes with rapidly fluctuating amplitude and phase. The origin of these fluctuations is demonstrated and the weather radar equation is developed. The weather Doppler spectrum and its principal moments are related to the spatial distribution of target reflectivity and its velocity. Example analyses of radar data from severe storms are presented. (Geiger-PTT)
W86-02008

MEASURING STORM RAINFALL BY RADAR AND RAIN GAGE,
National Severe Storms Lab., Norman, OK.
E. A. Brandes, and J. W. Wilson.
IN: Thunderstorms: A Social, Scientific and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation and Analysis, April 1982. p 241-277, 13 fig, 4 tab, 90 ref, 1 append.

Descriptors: *Radar, *Remote sensing, *Rain gages, *Data acquisition, *Comparison studies, Measuring instruments, Data collections, Weather data collections, Rainfall, Gages, Storms, Meteorological data collections.

Radar overcomes the primary difficulties associated with rain gages; radar measurements are over an area, available in real time, and from a single location. The cost of radar is similar to that of a dense rain gage network. Rain gages are simple, less costly, but often erroneous in their measurements. Instrument errors and areal errors of rain gages are described. The radar equation and calculation of rainfall rate are described. Factors causing errors in radar measurement of rainfall may be grouped into three broad categories: estimating of radar reflective factor; time and space averaging of substantial variations in reflectivity; and variations in the reflectivity-rainfall rate (Z-R) relationship and below-beam effects. A comparison of areal radar and gage measurements was made in nine experiments using one average relationship for all storms. The very large storm-to-storm and within storm errors in radar rainfall estimates dictate that estimates should be adjusted further. Adjustments usually involve either specifying the Z-R relationship by storm type or keeping the Z-R relationship fixed and using rain gage observations to correct the radar estimates. (Geiger-PTT)
W86-02009

USE OF SATELLITE OBSERVATIONS,
National Oceanic and Atmospheric Administration, Boulder, CO. Weather Modification Program Office.
R. A. Maddox, and T. H. VonderHaar.
IN: Thunderstorms: A Social, Scientific and Technological Documentary. Volume 3: Instruments and Techniques for Thunderstorm Observation and Analysis, April 1982. p 279-308, 22 fig, 52 ref.

Descriptors: *Satellite technology, *Thunderstorms, *Data acquisition, *Radiometry, *Weather data collections, Radar, Remote sensing, Storms, Weather modification, Meteorological data collections, Data collections, Cloud physics, Microwaves, Weather forecasting.

Satellite data are being developed for a variety of applications to thunderstorm research and operational forecasting and warning. The vertical-temperature profile radiometer has been used by NOAA satellites while the visible and infrared spin scan radiometer has been used by NASA. The rapid technological development of human/machine interactive computer systems that permits selective processing of digital satellite data is producing an increased amount of thunderstorm-related research. The NASA space shuttle will eliminate many restrictive weight and size limitations and allow more sophisticated infrared and microwave instruments to be placed in geosynchronous orbit. Satellite imagery is used in thunderstorm detection, monitoring, and forecasting by determining convective rainfall, monitoring movement and intensity of thunderstorm gust fronts, determining severe-thunderstorm/jetstream relationships and thunderstorm boundaries and intersections. Satellite technology has also been helpful in defining cloudtop tornadic signatures, studying mesoscale onvective weather systems, and examining cloudtop temperature fields, cloud motions and wind fields. Satellite technology has also aided studies involving thunderstorm microphysics such as weather modification. (Geiger-PTT)
W86-02010

EVAPOTRANSPIRATION OBTAINED FROM REMOTE SENSING METHODS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
J. L. Hatfield.
IN: Advances in Irrigation, Volume 2, Academic Press, New York. 1983. p 395-416, 15 fig, 62 ref.

Descriptors: *Evapotranspiration, *Remote sensing, *Soil-water-plant relationships, Canopy, Temperature, Infrared imagery, Spectral analysis, Microwaves, Soil water, Irrigation.

State-of-the-art remote sensing techniques for estimating crop stress and evapotranspiration include evapotranspiration models, infrared thermometry, spectral measurements, and microwave techniques. Canopy temperatures can be used to estimate crop stress directly and to estimate water availability to a crop. Canopy temperature is also combined w traditional methods to indicate crop water mands. (Cassar-PTT)
W86-02134

USE OF AERIAL PHOTOGRAPHY AN REMOTE SENSING IN THE MANAGEME OF HAZARDOUS WASTES,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 5
W86-02224

DETECTION OF SUBSURFACE SALINI WITHIN THE NORTHERN SLOPES REGIO OF VICTORIA, AUSTRALIA,
Commonwealth Scientific and Industrial Resear Organization, Canberra (Australia). Div. of Wa and Land Resources.
B. G. Williams, and M. Braunach.
IN: Salinity in Watercourses and Reservoirs, B terworth Publishers, Boston. 1984. p 515-524, 4 f 1 tab, 12 ref.

Descriptors: *Saline water, *Salinity, *Grou water, Subsurface mapping, Subsurface wat Electromagnetic induction, Exploration, Austral *Geophysical studies.

The application of electromagnetic induction determine the magnitude and spatial variability apparent electrical conductivity values, and th relation to underlying geology and secondary linization, are discussed. The broad scale reco naissance survey across the lower Northern Slop of Victoria indicates the magnitude of potent secondary salinization in that region. It also in cates the inherent variability in the distribution saline materials within the major geological form tions. The relatively coarse sampling frequency km) does not permit detailed speculation of pro lems and possible controls but it does indicate th approximately 300 km of that 500 km transect ha a potential for secondary salinization should t groundwater system be conducive to the mobiliz tion and transport of soluble salts. (Halterma PTT)
W86-02310

PROGRESS REPORT: PERFORMANCE C THE VIBRATING U-TUBE FLUID DENSIT GAGE FOR MEASURING SUSPENDED-SED MENT CONCENTRATION,
Geological Survey, Minneapolis, MN. Water R sources Div.
J. P. Beverage.
Available from Fed Inter-Agency Sed Proj, Anthony Falls Hyd. Lab, Minneapolis, MN 5541 U.S. Corps of Engineers, 1984. 16 p, 5 fig, 3 re

Descriptors: Measuring instruments, *Sediment Suspended load, *Settling tubes, *Fluid-densi gage, *Suspended-sediment concentration, *Den ty cell.

The vibrating U-tube fluid-density gage shov promise in automating the measurement of su pended-sediment concentration. The gage may operated with the U-tube in the upright vertic position to increase sensitivity at low sedime concentrations by stopping the flow and letting th sediment settle to the bottom. Sediment with particle-size range of 62 to 1000 micrometers w tested, and the sensitivity of the instrument i creased by a factor of five. The condensation humidity within the case was proved to be th cause of scattered readings at water temperatur below 12C. The gage response is linear with ca pressure. An improved reference oscillator w tested and shown to be satisfactory at ambie temperatures from 15 to 35C. The reference fr quency was increased to 20 kHz from the 12.8 kHz of the earlier studies. (USGS)
W86-02348

INSTRUMENTATION FOR MEASURIN LAKE AND RESERVOIR EVAPORATION B THE ENERGY-BUDGET AND MASS-TRANS FER METHODS,
Geological Survey, NSTL Station, MS. Water Re

ources Div.
. M. Sturrock.
Available from OFSS, USGS, Box 25425 Lake-ood, CO 80225. USGS Open-File Report 84-863, 985. 21 p, 7 fig, 4 ref.

Descriptors: *Evaporation, *Mass transfer, Energy budget, Reservoir evaporation, Lake vaporation, Air temperature, Water temperature, Instrumentation, Psychrometer, Micrologger, yranometer.

strumentation currently used by the U.S. Geo-gical Survey in studies of lake and reservoir vaporation is described in this paper. This instru-entation is used for the measurement of solar and rrestrial energy necessary to apply the mass-ansfer or energy budget methods. The energy dget requires a quantative determination of all rm of energy entering or leaving the lake as well determination of the change in storage of energy ithin the lake. (USGS)
86-02379

ISCHARGE RATINGS FOR CONTROL AGES AT MISSISSIPPI RIVER LOCK AND AM 11, DUBUQUE, IOWA,
eological Survey, Iowa City, IA. Water Re-urces Div.
r primary bibliographic entry see Field 4A.
86-02401

C. Evaluation, Processing and ublication

APS SHOWING GROUND-WATER LEVELS, RINGS, AND DEPTH TO GROUND WATER, ASIN AND RANGE PROVINCE, SOUTHERN ALIFORNIA,
ological Survey, Lakewood, CO. Water Re-rces Div.
r primary bibliographic entry see Field 2F.
86-01921

DIMENT YIELDS IN EASTERN MONTANA: MMARY OF DATA AND PROPOSED CHNIQUES FOR ESTIMATING SEDIMENT ELDS FROM SMALL, UNGAGED WATER-EDS,
ological Survey, Helena, MT. Water Resources .
r primary bibliographic entry see Field 2J.
86-01922

OUND-WATER DATA FOR MICHIGAN--3,
ological Survey, Lansing, MI. Water Resources .
r primary bibliographic entry see Field 2F.
86-01950

DROGEOLOGIC DATA FROM PARTS OF E DENVER BASIN, COLORADO,
ological Survey, Lakewood, CO. Water Re-rces Div.
primary bibliographic entry see Field 2F.
86-01952

OUND-WATER RESOURCES OF LANFAIR D FENNER VALLEYS AND VICINITY, SAN RNARDINO COUNTY, CALIFORNIA,
ological Survey, Sacramento, CA. Water Re-rces Div.
primary bibliographic entry see Field 2F.
86-01955

RIGATION DATA FROM CHASE, DUNDY, D PERKINS COUNTIES, NEBRASKA,
ological Survey, Lakewood, CO. Water Re-rces Div.
primary bibliographic entry see Field 2F.
86-01957

JANUARY 1984 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-01960

DEVELOPMENT AND EVALUATION OF TECHNIQUES FOR THE DETERMINATION OF THE GROUND-WATER POTENTIAL IN THE SOUTHERN ORANGE FREE STATE AND NORTHERN CAPE PROVINCE; VOLUME 5: STATISTICS AND DATA ANALYSIS,
Water Research Commission, Pretoria (South Africa).
G. J. Van Tonder, and F. D. I. Hodgson.
December 1981. 165 p, 29 fig, 25 tab, 33 ref. K5/17.

Descriptors: *Data processing, *Computer programs, *Statistical analysis, *Geohydrology, Mathematical studies, Standard deviation, Correlation coefficients, Cluster analysis, Linear regression, Maps, Contour maps, Graphical analysis, Factor analysis, Principal component analysis, Orange Free State, *South Africa.

A computerized hydrogeochemical data bank is available for users in South Africa. Three groups of programs are described: (1) programs to read data into the computer and obtain an output in the desired format (all data on a single sample or tables of data for multiple samples), (2) programs for statistical analysis (mean, mode, median, standard deviation, correlation coefficients, multiple linear regression, factor analysis, cluster analysis), and (3) programs to obtain graphical representation of data (histograms, Piper diagrams, Schoeller diagrams, sodium adsorption diagrams, contour maps, etc.). (Cassar-PTT)
W86-01993

MUNICIPAL SOLID WASTE MANAGEMENT FACILITY LOCATION MAPPING: SUPPORT ACTIVITIES REPORT,
Texas Natural Resources Information System, Austin.
For primary bibliographic entry see Field 5E.
W86-02320

EVALUATION OF THE GROUND-WATER RESOURCES OF COASTAL GEORGIA: PRELIMINARY REPORT ON THE DATA AVAILABLE AS OF JULY 1983,
Geological Survey, Doraville, GA. Water Resources Div.
R. E. Krause, S. E. Matthews, and H. E. Gill.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-228, 1984. 55 p, 21 fig, 4 tab, 120 ref.

Descriptors: *Hydrologic data, *Groundwater, *Well use, *Georgia, *Coastal area, *Monitoring networks, *Principal artesian aquifer, *Floridan aquifer, Test-well drilling.

A compilation of ground-water data that have been collected for nearly 100 years in the coastal area of Georgia as part of cooperative activities between the U.S. Geological Survey and other agencies is presented in this report. The compilation of pertinent data indicates that information is available for use in the evaluation of the ground-water resources of the 13 counties of coastal Georgia. Included in this report is a fairly complete discussion of previous and ongoing investigations and monitoring networks, and an extensive list of references. Maps at 1:24,000, 1:100,000; and 1:1000,000 scales contain well locations and identifers for all wells in the Ground Water Site Inventory (GWSI) data base of the National Water Data Storage and Retrieval System (WATSTORE). Tabular summaries of selected site information from GWSI, including well identifiers and names, latitude-longitude location, depth of well, altitude of land surface, and use of water are presented. Water-use data from the National Water Use Data System, and water use for irrigation from the University of Georgia, Department of Agriculture survey, are tabulated. Also included are pertinent information on geophysical surveys and data obtained, and proposed project activities, particularly test-monitor well drilling. (USGS)
W86-02352

PRINCIPAL FACTS FOR GRAVITY STATIONS IN THE HUMBOLDT HOUSE GEOTHERMAL AREA, PERSHING COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-02358

RECORDS OF SELECTED WELLS, ST. MARYS AND CALVERT COUNTIES, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
D. D. Drummond.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. Maryland State Basic Data Report 14, 1984. 117 p, 41 fig, 10 tab, 6 ref.

Descriptors: *Hydrogeologic data, Data collections, *Hydrologic data, *Maryland, *Calvery County, *St. Marys County.

Hydrogeologic data for Calvery and St. Marys Counties in southern Maryland were compiled from previously published and unpublished sources. The report includes records of wells inventoried by the U.S. Geological Survey such as state permit number, owner's name, driller, date drilled, elevation, well depth, aquifer, water-level data, discharge data, specific capacity, use of water, and pump type. Also included are observation well lists, lists of available geophysical logs, descriptive logs, chemical quality analyses, and pumpage data, as well as location maps for all data sites. (USGS)
W86-02359

MASS WATER-LEVEL MEASUREMENTS OF FALL 1984 IN THE CENTRAL PLATTE RIVER BASIN, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
J. T. Dugan.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-193, 1985. 22 p, 3 fig, 1 tab.

Descriptors: *Groundwater levels, *Observation wells, Data collections, Hydrologic data, *Nebraska, Central Platte River basin, *Water level measurements.

Mass water-level measurements were conducted in the Central Platte River basin, Nebraska, for the purpose of providing data to the U.S. Bureau of Reclamation for the development of a detailed map of water-table conditions during the fall of 1984. The objective was to provide a network of observation wells at approximately 2- to 3-mile intervals. In October and November 1984, 736 wells were measured, of which 526 were measured as part of existing ground-water observation-well networks. The remaining 210 wells not previously measured and required complete inventorying. The report consists of maps of the study area and locations of the observation wells. An appendix of pertinent well data includes: legal location, land-surface altitude, depth-to-water, water-table altitude, date of measurement, and type of well. (USGS)
W86-02360

ANALYSIS OF GROUND-WATER-QUALITY DATA IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. E. Davis, and G. D. Rogers.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4173, 1984. 177 p, 26 fig, 79 tabs, 56 ref.

Descriptors: *Water quality, Chemical properties, Environmental protection, *Montana, *WATSTORE, *Data collections.

Ground-water-quality data for Montana in the U.S. Geological Survey's computer data file WATSTORE were evaluated for nine geohydrologic units in part of the State east of the Rocky Mountains and for two geohydrologic units in the western mountainous part of the stated region. The availability of data for inorganic, trace, and organic constituents for each grouping of units was assessed. Median dissolved-solids concentrations for the groupings of units range from about 100 to 5,000 milligrams per liter. However, the number and distribution of data sites for some groupings of units wee inadequate to be representative of the aquifer as a whole. Concentrations of most trace constituents do not exceed Federal primary drinking-water standards, although exceptions occur. Few data were available for organic constituents. (USGS)
W86-02361

DRAINAGE BASINS IN ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. W. Foose.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4232, 1984. 1 map, 3 fig, 3 tab, 4 ref.

Descriptors: *Drainage basins, Ditches, Divides, Beach, Drainage patterns, Tidal streams, *Maps, *Florida, *St Johns County, Hydrologic units, *Drainage areas.

The highest point in St. Johns County, Florida is only slightly above 65 feet above sea level and drainage divides are indistinct and readily influenced by cultural features. This report delineates some 80 drainage basins (or artificial equivalents to natural basins such as the Intracoastal Waterway) within the county and their areas in square miles. Total area of St. Johns County is about 670 square miles. (USGS)
W86-02363

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE OF PROVINCE, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
B. T. Brady, M. S. Bedinger, D. A. Mulvihill, J. Mikels, and W. H. Langer.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4121-B. 14 p, 3 fig, 38 ref.

Descriptors: *Groundwater levels, *Springs, *Maps, Basin and Range province, *Texas.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing hydrologic properties of the Texas part of the Basin and Range province. The first map, at a scale of 1:500,000, shows the approximate altitude of the water table, and the location, temperature, and flow of large springs. The altitude of the water table is shown by contours where sufficient data exists; otherwise it is shown by data points. Springs with flows of 10 gallons per minute or more have been mapped. A second map at a scale of 1:1,000,000 shows the depth to ground water and areas of basin fill or consolidated rocks. In areas where the depth to ground water is less than 500 feet, the depth is shown by lines of equal depth to water or data points where data are insufficient to draw lines. Areas where the depth to the water table is generally greater than 500 feet. (USGS)
W86-02366

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
B. T. Brady, M. S. Bedinger, and J. Mikels.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4121-A, 1984. 13 p, 3 fig, 38 ref.

Descriptors: *Groundwater, *Groundwater movement, *Maps, Selective withdrawal, Groundwater levels, Basin and Range province, *Texas.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing hydrologic properties of the Texas part of the Basin and Range province. The first map, at a scale of 1:500,000, divides the area into ground-water units, which approximate ground-water drainage. In addition to ground-water units, the map shows consolidated-rock areas, basin fill, generalized ground-water flow directions, and man-induced and natural-discharge areas. A second map at a scale of 1:1,000,000 shows quantity of ground-water withdrawal. (USGS)
W86-02367

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
M. S. Bedinger, J. S. Gates, and J. R. Stark.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4122-A, 1984. 22 p, 3, fig, 1 tab, 98 ref.

Descriptors: Groundwater, *Groundwater movement, *Maps, Groundwater levels, Selected withdrawal, Hydrogeology, *Basin and Range province, *Utah.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic properties of the Utah part of the Basin and Range province. The first map, at a scale of 1:500,000 divides the area into ground-water units, which approximate ground-water drainage. In addition to ground-water units, the map shows consolidated-rock areas, basin fill, generalized ground-water flow directions, and man-induced and natural-discharge areas. A second map at a scale of 1:1,000,000 shows quantity of ground-water withdrawal. (USGS)
W86-02368

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
M. S. Bedinger, W. H. Langer, and W. R. Moyle.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-A, 1984. 12 p, 3 fig, 40 ref.

Descriptors: Groundwater, *Groundwater movement, *Maps, Groundwater levels, Selective withdrawal, Hydrogeology, *Basin and Range province, *California.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic properties of the southern California part of the Basin and Range province. The first map, at a scale of 1:500,000, divides the area into ground-water units, which approximate ground-water drainage. In addition to ground-water units, the map shows consolidated-rock areas, basin fill, generalized ground-water flow directions, and man-induced and natural-discharge areas. A second map at a scale of 1:1,000,000 shows quantity of ground-water withdrawal. (USGS)
W86-02369

GEOLOGIC AND HYDROLOGIC DATA COLLECTED DURING 1976-1984 AT THE SHEFFIELD LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE AND ADJACENT AREAS, SHEFFIELE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02372

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI, FISCAL YEAR 1985,
Geological Survey, Rolla, MO. Water Resources Div.
W. M. Kratzer, and K. L. Jenkins.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-188, 1985. 57 p, 8 fig, 1 tab, 64 ref.

Descriptors: *Missouri, *Hydrologic data, *Networks, Streamflow, *Gaging stations, Data collection, District projects, *Hydrologic reports.

Water-resource activities of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretive studies. These projects are funded through joint-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds. These data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the hydrologic data-collection program and local or areal investigations in Missouri for fiscal year 1985 and provides a list of selected water-resources references for Missouri. (USGS)
W86-02375

GROUND-WATER DATA FOR GEORGIA, 1984,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, S. A. Longsworth, K. W. McFadden, and M. F. Peck.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-331, 1985. 150 p, 71 fig, 48 tab, 40 ref.

Descriptors: *Groundwater, *Water levels, Aquifers, *Georgia, Water quality, *Groundwater data, Groundwater levels, Groundwater quality.

Continuous water-level records from 155 wells and more than 800 water-level measurements made in Georgia during 1984 provide the basic data for this report. Selected wells illustrate the effects that changes in recharge and pumping have had on the various ground-water resources in the State. Daily mean water levels are shown in hydrographs for 1984. Monthly means are shown for the 10-year period 1975-84. Mean annual water levels ranged from 7 feet lower to 7 feet higher in 1984 than in 1983. Water-quality samples are collected periodically throughout Georgia and analyzed as part of a real and regional ground-water studies. Along the coast, chloride concentrations in the Floridan aquifer system generally remained steady. (USGS)
W86-02376

GAZATTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--MERRIMACK RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, and R. A. Fontaine.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4284, 1984. 54 p, 5 fig, 5 tab, 32 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, Nashua River basin, Concord River basin, Shawsheen River basin, Lower Merrimack River basin, *Maps.

The Merrimack River basin in northeastern Massachusetts includes streams draining the Nashua (507 square miles), Concord (400 square miles), Shawsheen (78.0 square miles), and lower Merrimack (275 square miles) River basins. Drainage areas using the latest available 1:24,000 scale topographic maps were computed for the first time for

treams draining more than 3 square miles and vere recomputed for data collection sites. Stream-ow characteristics at 12 gaging stations were alculated using a new data base with daily flow ecords through 1981. These characteristics in-lude annual and monthly flow statistics, duration f daily flow values, and the annual 7-day mean w flow at the 2-year and 10-year recurrence tervals. Seven-day low-flow statistics are pre-nted for 79 partial-record sites and procedures ed to determine the hydrologic characteristics of basin are summarized. Basin characteristics rep-senting 14 commonly used indices to estimate arious streamflows are presented for 12 gaged reams. This gazetteer will aid in the planning and ing of water-resources related activities, and will ovide a common data base for governmental gencies and the engineering and planning commu-ties. (USGS)
86-02381

APS SHOWING GROUND-WATER LEVELS, PRINGS, AND DEPTH TO GROUND WATER, ASIN AND RANGE PROVINCE, NEVADA,
eological Survey, Lakewood, CO. Water Re-urces Div.
S. Bedinger, J. R. Harrill, W. H. Langer, J. M. homas, and D. A. Mulvihill.
vailable from OFSS, USGS, Box 25425, Lake-od, CO 80225. USGS Water-Resources Investi-tions 83-4119-B, 1984. 11 p, 3 fig, 2 pl, 75 ref.

escriptors: *Groundwater levels, Springs, Hy-ologic data, Hydrogeology, *Basin and Range ovince, *Nevada, *Maps.

is map report is part of a U.S. Geological rvey project to characterize the geology and drology of the Basin and Range province. The ort consists of two maps describing selected drologic properties of the Nevada part of the in and Range province. The first map, at a scale 1:500,000, shows the approximate altitude of the ter table, and the location, temperature, and w of large springs. The altitude of the water le is shown by contours where sufficient data ts; otherwise it is shown by data points. Springs h flows of 10 gallons per minute or more have n mapped. A second map at a scale of 000,000 shows the depth to ground water and as of basin fill or consolidated rocks. In areas ere the depth to water is less than 500 feet, the th is shown by lines of equal depth to water or points where data are insufficient to draw s. Areas are shaded where the depth to the er table is generally greater than 500 feet. GS)
6-02384

PS SHOWING GROUND-WATER UNITS D WITHDRAWAL, BASIN AND RANGE OVINCE, NEVADA,
logical Survey, Lakewood, CO. Water Re-ces Div.
. Bedinger, J. R. Harrill, and J. M. Thomas.
ilable from OFSS, USGS, Box 25425, Lake-d, CO 80225. USGS Water-Resources Investi-ons 83-4119-A, 1984. 10 p, 3 fig, 2 pl, 75 ref.

criptors: *Groundwater, *Groundwater move-t, Hydrologic data, Hydrogeology, Selective drawal, *Basin and Range province, *Nevada, ps.

map report is part of a U.S. Geological ey project to characterize the geology and ology of the Basin and Range province. The rt consists of two maps describing selected ologic properties of the Nevada part of the n and Range province. The first map, at a scale 500,000, divides the area into ground-water , which approximate ground-water drainage. ldition to ground water units, the map shows olidated-rock areas, basin fill, generalized nd-water flow directions, and man-induced natural-discharge areas. A second map at a of 1:1,000,000 shows quantity of ground-r withdrawal. (USGS)
-02385

MAPS SHOWING GROUND-WATER UNITS AND WITHDRAWAL, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
M. S. Bedinger, T. W. Anderson, and W. H. Langer.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-A, 1984. 7 p, 3 fig, 2 pl, 41 ref.

Descriptors: *Groundwater, *Groundwater movement, Hydrologic data, Selected withdrawal, Hydrogeology, *Basin and Range province, *Arizona, *Maps.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic properties of the Arizona part of the Basin and Range province. The first map, at a scale of 1:500,000, divides the area into ground-water units, which approximate ground-water-table divides or topographic divides. In addition to ground-water units, the map shows consolidated-rock areas, basin fill, generalized ground-water flow directions, and man-induced and natural-discharge areas. A second map at a scale of 1:1,000,000 shows quantity of ground-water withdrawal. (USGS)
W86-02386

MAPS SHOWING GROUND-WATER LEVELS, SPRINGS, AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
M. S. Bedinger, J. L. Mason, W. H. Langer, J. S. Gates, and J. R. Stark.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4122-B, 1984. 12 p, 3 fig, 1 pl, 123 ref.

Descriptors: *Groundwater levels, Springs, Hydrologic data, Hydrogeology, *Basin and Range province, *Utah, *Maps.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps describing selected hydrologic properties of the Utah part of the Basin and Range province. The first map, at a scale of 1:500,000, shows the approximate altitude of the water table, and the location, temperature, and flow of large springs. The altitude of the water table is shown by contours where sufficient data exists; otherwise it is shown by data points. Springs with flows of 10 gallons per minute or more have been mapped. A second map at a scale of 1:1,000,000 shows the depth to ground water, and areas of basin fill or consolidated rocks. In areas where the depth to water table is less than 500 feet, the depth is shown by contours of data points where data are not sufficient to draw contours. Areas are shaded where the depth to the water table is generally greater than 500 feet. (USGS)
W86-02387

SURFACE-WATER INFLOW TO PUGET SOUND, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
J. R. Williams.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4090. 6 plates, 11 tab.

Descriptors: *Stream discharge, Water quality, Regression analysis, *Surface waters, *Streamflow, Puget Sound, Strait of Juan de Fuca, *Washington, Exceedance probabilities, *Maps.

Estimates were made of the annual and seasonal mean discharges that have 10- (wet year), 50- (normal year), and 90- (dry year) percent probabilities of exceedance at the mouths of all streams in the Puget Sound area, Washington, that have a mean annual flow of 20 cu ft/sec. or more. The information, an important factor in assessing the quality of water in Puget Sound and the Strait of Juan de Fuca, is presented on five map plates. (USGS)
W86-02395

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN TEXAS--FISCAL YEARS 1982-84,
Geological Survey, Austin, TX. Water Resources Div.
R. U. Grozier, and L. F. Land.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-346, 1985. 60 p, 1 tab.

Descriptors: *Groundwater, *Surface water, *Water quality, *Hydrologic data collection, *Data collections, *Texas, Water-resources appraisals.

Water-resources activities in Texas include the collecting of hydrologic data, performing interpretive studies, and conducting research projects. This report describes the activities of the Water Resources Division of the U.S. Geological Survey in Texas for fiscal years (October to September) 1982 to 1984. (USGS)
W86-02396

STREAM DISCHARGE IN MICHIGAN--MISCELLANEOUS MEASUREMENTS,
Geological Survey, Lansing, MI. Water Resources Div.
D. J. Holtschlag, and D. V. Eagle.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-350, 1985. 344 p, 5 fig, 10 tab, 3 ref.

Descriptors: *Hydrologic data collections, *Streamflow, *Michigan, Discharge, Water yield.

This report contains 17,607 miscellaneous stream discharge measurements made at 2,897 sites in Michigan. An average of 515 measurements were made each year from 1960 through 1984; most of these were made from April through October of each year. Miscellaneous measurements include periodic and occasional measurements of streamflow at sites where systematic records are unavailable. (USGS)
W86-02409

APPROACH FOR APPRAISING THE ACCURACY OF SUSPENDED-SEDIMENT DATA,
Geological Survey, Sacramento, CA. Water Resources Div.
D. E. Burkham.
Available from Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Professional Paper 1333, 1985. 18 p, 4 fig, 1 tab, 14 ref.

Descriptors: *Statistical analysis, *Statistical methods, *Suspended sediments, Sediment discharge, Error analysis, Sediment concentration, Sand, Streams.

Procedures are presented for appraising the accuracy of suspended-sediment data. Types of errors involved are sampling error, spatial error, temporal error, and sediment-discharge error. The standard error of estimate is used to represent errors. Suspended-sediment data for 17 U.S. Geological Survey gaging stations in Arizona, California, Nebraska, New Mexico, Pennsylvania, and Washington are used in applications of the procedures. For the study sites, the magnitudes of the different types of error apparently vary directly with percentage of sediment-water mixture that is sand; when the percentage sand is relatively high, magnitudes of the different types of error have a relatively wide range. For seven sites of the Sacramento River, Calif., and its tributaries, the standard sampling error apparently can range from 2.5 percent when percentage sand is relatively low to 20 percent when percentage sand is relatively high. For 16 sites in Arizona, California, Nebraska, New Mexico, and Pennsylvania, the coefficient of variation for concentrations of suspended sediment

across streams apparently can range from 2.5 percent (low percentage sand) to 70 percent (high percentage sand). (USGS)
W86-02415

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--HUDSON RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4250, 1984. 24 p, 5 fig, 5 tab, 29 ref.

Descriptors: *Drainage flow, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, Hoosic River basin, *Maps.

The Hudson River basin includes streams draining the Hoosic River (205 square miles), Kinderhook Creek (20.9 square miles), and Roeliff Jansen Kill (13.3 square miles) basins in western Massachusetts, eastern New York, and southern Vermont. Drainage areas, using the latest available 1:24,000 scale topographic maps, are re-computed for data-collection sites and computed for the first time for streams draining greater than 3 square miles. Basin characteristics representing 14 commonly used indices to estimate various streamflows are presented for the five gaged streams in the Hoosic River basin. Streamflow characteristics, representing statistics computed using a new data base with records through 1979, include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 21 partial-record sites. The procedures used to determine the hydrologic characteristics are summarized. This gazetteer of hydrologic characteristics will aid in the planning and siting of water-resources-related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02416

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--COASTAL RIVER BASINS OF THE NORTH SHORE,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4281, 1984. 60 p, 5 fig, 5 tab, 47 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, *Flow characteristics, Streamflow, Surface water, *Massachusetts, Rowley River basin, Parker River basin, Ipswich River basin, Mystic River basin, Charles River basin, Neponset River basin, Weymouth River basin, Weir River basin, *Maps.

The coastal river basins of the North Shore and Boston Bay include streams draining the Parker River (60.4 square miles), Rowley River (9.9 square miles), Ipswich River (156 miles), Mystic River (66.0 square miles), Charles River (311 square miles), Neponset River (117 square miles), Weymouth Fore and Weymouth Back Rivers (about 63 square miles) and Weir River (about 20 square miles) basins. The study area in eastern and northeastern Massachusetts also includes the minor river basins draining into Massachusetts Bay, Ipswich Bay, or the Atlantic Ocean. Drainage areas using the latest available 1:24,000 scale topographic maps were computed for the first time for streams draining more than 3 square miles and were recomputed for data-collection sites. Streamflow characteristics at 15 gaging stations were calculated using a new data base with daily flow records through 1981. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 95 partial-record sites and the procedures used to determine the hydrologic characteristics of a basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are presented for 15 gaged streams. This gazetteer will aid in the planning and siting of water-resources related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02418

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--CONNECTICUT RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4282. 110 p, 10 ill, 5 tab, 39 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, *Connecticut River basin, *Maps.

The Connecticut River basin study area includes streams draining the Ashuelot River (6.6 square miles), Millers River (389 square miles), Deerfield River (663 square miles), Chicopee River (727 square miles), Westfield River (517 square miles), Farmington River (158 square miles), and Connecticut River lowlands (656 square miles) basin in western Massachusetts, northern Connecticut, southern Vermont, and southern New Hampshire. Drainage areas, using the latest available 1:24,000 scale topographic maps, were computed for the first time for streams draining more than 3 square miles and were re-computed for data-collection sites. Streamflow characteristics at 45 gaging stations, representing statistics were calculated using a new data base with daily flow records through 1981. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 118 partial-record sites, and the procedures used to determine the hydrologic characteristics of a basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are presented for 54 sites in the Connecticut River basin. This gazetteer will aid in the planning and siting of water-resources related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02419

8. ENGINEERING WORKS

8A. Structures

MODEL STUDY ON WAVE ABSORBERS FOR APPLICATION IN HARBOURS ALONG THE SOUTH AFRICAN COASTLINE,
National Research Inst. for Oceanology, Stellenbosch (South Africa). Coastal Engineering and Hydraulics Div.
D. J. P. Scholtz.
Available from the National Technical Information Service, Springfield, VA 22161 as N83-11686, Price codes: A06 in paper copy, A01 in microfiche. CSIR Report T/SEA 8114, September 1981. 117 p, 73 fig, 7 tab, 20 ref.

Descriptors: *Hydraulics, *Erosion control, *Waves, Harbors, *South Africa, Model studies, Coastal engineering, *Breakwaters, *Shore protection, *Bank protection, Wave absorbers.

The performance of wave absorbers for South African harbors was studied using a model. Tests were done on rubble slopes, dolos slopes, discontinuous composite rubble slopes, patented absorber blocks, and a column wave absorber. Generally, the reflection coefficients were high when the relative depth was low, and vice versa. The wave steepness had an insignificant effect on the reflec tion coefficient in the wave steepness range c 0.004 to 0.024. The individual mean reflection co efficients for dolos slopes and rubble slopes wer similar, 0.37 and 0.35, respectively, for relativ depths of 0.10 and 0.13 and for wave steepness c 0.004-0.024. The reflection coefficients for narrow structures (6.0-6.5 m wide in the model) were hig (0.6-0.8). Smaller reflection coefficients were ob tained for wider structures. For example, reflecte wave heights were 0.3-0.4 for structures 18.00 18.75 m wide in the prototype. With the colum wave absorber, reflected wave height decrease linearly with increase in width. The efficiency o the most effective hollow-block type (column) an of the slope type (composite slope with ratio o depth of top of vertical face of the discontinuou composite rubble slope below SWL to water dept at structure = 0.4) wave absorbers was simila (reflected wave height = 0.5) for w/d (width water depth) = 1. The latter was more efficient fo w/d > 1 and less efficient for w/d < 1. (Cassar PTT)
W86-02000

AIR DEMAND AND VIBRATION MEASURE MENTS, WYNOOCHEE DAM, WYNOOCHEE RIVER, WASHINGTON,
Army Engineer Waterways Experiment Station Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-02002

CONDITION SURVEY OF CEDARS LOCK AND DAM, LOWER FOX RIVER, WISCONSIN
Army Engineer Waterways Experiment Station Vicksburg, MS. Structures Lab.
R. L. Stowe, and J. C. Ahlvin.
Miscellaneous Paper SL-82-4, June 1982. Fina Report. 114 p, 2 fig, 5 tab, 26 plates, 2 app, exhibit, 7 ref.

Descriptors: *Cedars Lock and Dam, *Wisconsin *Dam inspection, Concrete dams, Elastic modulus Shear strength, Triaxial strength, Poisson's ratio

A condition survey was performed at Cedars Lock and Dam on the Lower Fox River, Wisconsin Results of the field investigation and laboratory tests indicated that the concrete in the lock and dam is locally cracked and lightly deteriorated bu structurally sound. Rock masonry in the lock ap pears sound even though the outside surface i weathered. Cycles of freezing and thawing have caused the deterioration. The lock and dam i founded on competent bedrock. Soundings should be made to detect any scouring behind the dam. I is suggested that the reinforced steel in the tainter gate piers, adjacent to the hinge pins, be examined for corrosion. The field investigation included drilling for core samples of concrete, foundation rock, and backfill. Selected specimens of these materials were tested in the laboratory for certain physical and mechanical properties. Data on unit weight, compression wave velocity, compression strength, water content, elastic moduli and Poisson's ratio are presented for concrete cores. Data on effective and dry unit weight, water content compression shear strength are presented for the rock cores. (Author's modified-abstract)
W86-02036

8B. Hydraulics

MODEL STUDY ON WAVE ABSORBERS FOR APPLICATION IN HARBOURS ALONG THE SOUTH AFRICAN COASTLINE,
National Research Inst. for Oceanology, Stellenbosch (South Africa). Coastal Engineering and Hydraulics Div.
For primary bibliographic entry see Field 8A.
W86-02000

AIR DEMAND AND VIBRATION MEASURE-MENTS, WYNOOCHEE DAM, WYNOOCHEE RIVER, WASHINGTON,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.

E. D. Hart.
Miscellaneous Paper HL-82-2, December 1982. Final Report, 45 p, 10 fig, 5 tab, 16 plates, 13 ref.

Descriptors: *Hydraulics, *Vibrations, *Dams, *Gates, Air demand, Hydraulic structures, *Wynoochee Dam, *Washington, Sluice gates.

Tests were conducted at the Wynoochee Dam, Washington, after vibrations were noted during sluice discharges. The measurement program included (a) the magnitude of vibrations occurring at the dam, the Vista House, and sluice gate, (b) gate-lip pressure fluctuations, (c) air flow rates, (d) the correlation between the gate and Vista House vibrations. Measurements were made with gate openings at 1-ft increments from 1 to 10 ft with an essentially full pool. Some correlation was seen between the frequency of the gate-lip pressure fluctuations and both the accelerations of the Vista House and the air-vent pressure fluctuations during the test with a gate opening of 9 ft. The maximum p-p acceleration recorded during the test was 0.0008 g. The maximum recorded air-vent velocity and head loss were within suggested limits. The ratio of air discharge through the vent and water discharge in the sluice plotted reasonably well on the suggested design curve. Air-vent flow reached a maximum when the sluice gate was fully open. Air flowed into the sluice exit portal at all gate openings for which measurements were made. (Cassar-PTT)
W86-02002

8C. Hydraulic Machinery

HAND-PUMP TECHNOLOGY FOR THE DEVELOPMENT OF GROUNDWATER RESOURCES,
Agency for International Development, Washington, DC.
J. E. McJunkin, and E. H. A. Hofkes.
In: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 37-52, 1 fig, 11 ref.

Descriptors: *Groundwater, *Pumps, *Pump wells, *Water supply development, *Developing countries, Pump testing, Water supply, Water resources development, Maintenance costs, Models, Rural areas.

In areas where groundwater is readily available at moderate depth, constructing a number of wells fitted with hand pumps is by far the cheapest means of providing a good water supply. The most common hand pump is the reciprocating type. Inherent features of the reciprocating hand pump are subject to friction and wear. The diaphragm pump is another type of positive displacement pump. In the rotary-type pump, the helical rotary requires no valves nor cup seals, and in place of the reciprocating lever linkage of the pump head, it has a rotary crank with a right-angle gearbox to turn the rotor. The local manufacture of the hand pump is desireable due to lower capital costs of production, transportation savings, reduction in foreign exchange requirements, stimulation of local initiative, industry and labor, and better availability and access to repair and replacement parts. Most hand-pump maintenance programs can be characterized as a one-level or two-level system. The one-level system is one where all maintenance is the responsibility of the central organization. In the two-level organization, maintenance is shared with local villages or communities. Hand pumps are compared and selected on the basis of relative total cost, capital costs of purchase and installation, plus costs of operation and maintenance. A protocol for evaluating and comparing hand pumps is now under development. (Geiger-PTT)
W86-02327

RENEWABLE ENERGY PUMPING FROM RIVERS AND STREAMS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
J. Schiller.
In: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 53-64, 6 fig, 1 tab, 6 ref.

Descriptors: *Pump turbines, *Streams, *Pumps, *Water supply development, *Developing countries, Hydraulic equipment, Streamflow, Rivers, Pumping, Pump testing, Water supply, Water resources development, Maintenance costs.

In developing countries, there are many situations where water is available from a nearby stream. Various devices have been constructed to utilize the energy available in flowing streams. This chapter reviews two of the more successful devices: the hydraulic ram pump (hydram) and the low head turbine pump. The hydram converts pressure energy to mechanical work, while the low-head turbine pump converts kinetic energy to mechanical work. The hydram works more efficiently, and in general its capital cost is approximately half that of the Platapump turbine pump. There is, however, ancillary equipment that must be installed with the hydram (feed tank, drive pipe, pump compartment), making it a rather permanent installation. The turbine pump can be installed quite easily with a simple dam, and is fairly temporary and portable. In terms of operation and maintenance, the hydram, with two moving valve parts, would probably be easier to maintain. (Geiger-PTT)
W86-02328

WIND-POWER PUMPING,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
G. M. Bragg.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Sciences, Ann Arbor, MI, 1982. p 65-84, 7 fig, 4 tab, 3 ref.

Descriptors: *Pumps, *Pump turbines, *Wind, *Hydraulic equipment, Pumped storage, Pumping, Turbines, Pump testing, Hydraulic machinery, Design criteria, *Windmills.

Several aspects of wind power pumping are outlined, with emphasis on the data needed to decide on the basic types of wind power devices to be used and the availability of wind for power generation. Historically, most windmills have been used for grinding and water pumping. When deciding on windmill location, optimum geographic placement, variation of wind speed with heights and time, and maximum winds for stress analysis should be considered. Windmill designs should be stress-analyzed comprehensively before construction. The most common type of water pumping windmill is the American farm windmill. Many new designs of this type of windmill are becoming available. These new machines are capable of pumping water using positive-displacement pumps at depths up to 200 or more meters. The mechanical simplicity of vertical axis water pumping windmills suggests that machines of this type may become popular in the future. The most common positive-displacement pump for water applications at present is the reciprocating type. In North America, centrifugal pumps have been used to provide water pumping while being driven electrically by submersible motors. In the case of water pumping, the economic and engineering advantages are often strongly in favor of wind power. The peak achievable efficiency for aerodynamic optimization is 0.59, if angular momentum effects, drag and tip losses are ignored. Optimization of a wind turbine connected to a pump or electrical generator is considered. (Geiger-PTT)
W86-02329

8D. Soil Mechanics

INFLUENCE OF A SHALLOW WATER TABLE ON CRATERING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
B. L. Carnes.
Technical Report SL-81-6, September 1981. Final Report. 118 p, 21 fig, 10 tab, 9 ref, 4 append. 4A762719AT40.

Descriptors: *Soil mechanics, *Excavation, *Explosives, *Water table, Rapid excavation, Water level, Sand, Craters, Shallow water table.

The influence of a shallow water table on crater shapes and sizes in various types of soils was investigated. Tests using high-explosive charges ranging from 1 to 322 pounds were conducted at four separate sites. Site 1 was a specially constructed sand basin with a variable water table level. Site 2 was a natural sandbar of the Mississippi River near Vicksburg. Site 3 was on a natural sand site in central Florida, and Site 4 was a layered clay/sand site at Camp Shelby, Mississippi. Results showed that craters of drastically different shapes can be formed in the presence of a near-surface water table if the water table is in a highly saturated, loose, granular material. Wide, shallow craters were caused by soil liquefaction in loose, saturated, fine medium-loose sands; however, in a relatively dense sand that was not fully saturated, craters were 5 to 10% smaller in radius and depth than normal (in homogeneous soil), but still regular and bowl-shaped. In a clay/sand environment, craters tended to be about 10 to 15% wider than normal because of sloughing crater slopes of soft clay caused by the shallow water table in the sand.
W86-01999

RELATIONSHIP OF LABORATORY AND FIELD DETERMINED HYDRAULIC CONDUCTIVITY IN COMPACTED CLAY SOILS,
Agricultural Research Service, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2F.
W86-02119

8E. Rock Mechanics and Geology

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4122-D, 1984. 11 p, 2 fig, 68 ref.

Descriptors: *Granitic rocks, Aquifers, Hydrogeology, *Geologic maps, *Basin and Range province, Utah.

Outcrops of granitic rocks have been delineated in Utah as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, geologic age, distribution, and sources of data of the granitic rocks, are described. (USGS)
W86-01938

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFF AND LAHARIC BRECCIA, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness, K. Roggensack, and D. A. Lopez.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4118-F, 1984. 24 p, 93 ref.

Descriptors: *Ash-flow tuff, *Laharic breccia, *Aquifers, Hydrogeology, Basin and Range province, *New Mexico, Geologic maps.

Outcrops of ash-flow tuff and laharic breccia have been delineared in New Mexico as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the rocks are described. Also, caladreas and cauldrons from which the major tuffs erupted are described. (USGS)
W86-01939

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Re-

sources Div.
W. D. Johnson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-E, 1984. 11 p, 2 fig, 2 pl, 61 ref.

Descriptors: *Argillaceous Rocks, Aquifers, *Geologic maps, *Basin and Range province, *Arizona.

Outcrops of formations containing thick units of argillaceous rocks in Arizona as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution of the rocks, and the sources of data are described. (USGS)
W86-01945

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. D. Johnson, and R. B. Scarborough.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-D, 1984. 33 p, 2 fig, 2 pl, 135 ref.

Descriptors: *Granitic rocks, Aquifer, *Geologic maps, *Basin and Range province, *Arizona.

Outcrops of granitic rocks of part of Arizona have been mapped as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, geologic age, distribution, and the sources of data of the granitic rocks are described. (USGS)
W86-01946

MAP SHOWING OUTCROPS OF PRE-QUATERNARY BASALTIC ROCKS, BASIN AND RANGE PROVINCE, ARIZONA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. D. Johnson, and R. B. Scarborough.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-G, 1984. 19 p, 3 fig, 2 pl, 93 ref.

Descriptors: *Basaltic rocks, Aquifers, *Geologic maps, *Basin and Range province, *Arizona.

Outcrops of basaltic rocks older than 2 million years have been delineated in Arizona as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and the sources of data for the basaltic rocks, are described. (USGS)
W86-01947

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY AGRILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
W. D. Johnson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4122-E, 1984. 10 p, 1 fig, 1 tab, 52 ref.

Descriptors: *Agrillaceous rocks, Aquifers, Geologic maps, *Basin and Range province, *Utah.

Outcrops of thick argillaceous sedimentary and metasedimentary rocks generally in excess of 500 feet thick have been delineated in Utah as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The sources of data, lithologic chracter, thickness, and distribution of thick argillaceous geologic units ranging in age from Late Proterozoic to Late Cretaceous are described. (USGS)
W86-01948

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE PROVINCE,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness, D. A. Lopez, and J. R. LaFortune.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4114-F, 1984, 16 p, 2 fig, 66 ref.

Descriptors: *Tuffs, *Volcaniclastic rocks, Aquifers, *Geologic maps, *Basin and Range province, *Arizona.

Outcrops of ash-flow tuffs and valcaniclastic rocks older than 2 million years have been delineated in Arizona as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and the sources of data for the rocks, are described. (USGS)
W86-01972

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND PRE-QUATERNARY ASH-FLOW TUFFS, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness, K. A. Sargent, and D. A. Lopez.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4120-D, 1984. 12 p, 2 fig, 41 ref.

Descriptors: *Granitic rocks, *Ash-flow tuffs, Calderas, *Geologic maps, Aquifers, *Basin and Range province, *Oregon.

Outcrops of granitic rocks and pre-Quaternary ash-flow tuffs have been delineated within the Basin and Range province or Oregon as part of a study by the U.S. Geological Survey to identify potentially suitable regions for future study for disposal of high-level nuclear waste within the Basin and Range province, western United States. The distribution, lithologic character, geologic and, if available, radiometric age, thickness (where appropriate), and sources of data of the geologic units are described. Locations of known and postulated calderas are shown, and they are briefly described. (USGS)
W86-01973

MAP SHOWING OUTCROPS OF PRE-QUATERNARY BASALTIC ROCKS, BASIN AND RANGE PROVINCE, OREGON,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness, K. E. Sargent, and D. A. Lopez.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4120-E, 1984. 8 p, 2 fig, 27 ref.

Descriptors: *Basaltic rocks, *Geologic maps, Hydrogeology, *Basin and Range province, *Oregon, Aquifers.

Outcrops of basaltic rocks have been delineated in Oregon as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the basaltic rocks are described. (USGS)
W86-01974

PRINCIPAL FACTS FOR GRAVITY STATIONS IN THE HUMBOLDT HOUSE GEOTHERMAL AREA, PERSHING COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
B. G. Duffrin, D. L. Berger, and D. H. Schaefer.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-163, 1985. 11 p, 1 tab, 2 ref, 1 fig.

Descriptors: *Gravity Studies, *Geophysics, Gravimetric prospecting, *Humboldt House area, Pershing County, *Nevada.

Principal fact for 172 gravity stations in and nea Humboldt House, Nevada are tabulated; they co sist of latitude, longitude, altitude, observed grav ty, free-air anomaly, terrain correction, and Bou guer anomaly values, at a bedrock density of 2.6 grams per cubic centimeter. (USGS)
W86-02358

8G. Materials

LABORATORY INVESTIGATION OF PHYSI CAL PROPERTIES OF FLEXIBLE MEM BRANE LINERS (FML),
Carlisle SynTec Systems, PA.
B. D. Gish, and W. E. Witherow.
IN: Toxic and Hazardous Wastes, Technomic Pub lishing Co. Lancaster, PA. 1984. p 510-519, 14 fig

Descriptors: *Membranes, *Impervious mem branes, *Materials testing, *Linings, Materials en gineering, Rubber, Elastomers, Polymers.

A wide spectrum of physical properties, especiall durability and degradation, for the most commo non-reinforced and fabric reinforced flexible mem brane liners (FML's) e.g., butyl and ethylene pro pylene diene monomer (EPDM), rubbers and ther moplastic polyvinyl chloride (PVC), chlorinated polyethylene (CPE) and chlorosulfonated polyeth ylene (CSM) were investigated. All of these mate rials are used widely today in many canal, reser voir, wastewater, and dam projects. Testing wa performed in accordance with the latest America Society of Testing and Materials methods. Wate resistance, tensile strength, elongation, dimensiona stability, and puncture resistance were determine on five commercially available membranes (Buty rubber, EPDM, rubber, thermoplastics CPE, ther moplastic PVC, and Hypalon). Physical character istics were determined after heat aging for 28 day at 70degrees and for 7 days at 116 degrees. Buty rubber showed the least dimensional changes, th highest puncture resistance, good retention of brit tle point, and the least permeability. Thermoplastic PVC and CSM increased in tear resistance afte heat aging. PVC exhibited the worst tensile strength retention after 28 days at 70 degrees (Geiger-PTT)
W86-02120

8H. Rapid Excavation

INFLUENCE OF A SHALLOW WATER TABLE ON CRATERING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8D.
W86-01999

8I. Fisheries Engineering

HABITAT SUITABILITY INDEX MODELS: RE GRESSION MODELS BASED ON HARVEST OF COOLWATER AND COLDWATER FISHES IN RESERVOIRS,
Fish and Wildlife Service, Fayetteville, AR. National Reservoir Research Program.
For primary bibliographic entry see Field 2A.
W86-01985

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

TRAINING OF COUNTERPARTS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
E. J. Schiller.
IN: Water Supply and Sanitation in Developing Countries, Ann Arbor Science, Ann Arbor, MI, 1982. p 343-361, 1 fig, 11 ref.

Descriptors: *Education, *Training, *Water supply development, *Sanitation, *Developing

ountries, Case studies, Project planning, Future lanning, Manpower, Personnel.

raining of personnel will be a key factor in any xpansion of water supply and sanitation systems. o train personnel, students may go outside the ountry for specialized training not available ithin the country, outside teachers may come to the country, or local teachers may be used to ain local personnel using local institutions. Train- g plans should be preceded by a proper manpow- survey. Most developing countries focus on eration/maintenance as the most critically eded training. Practical on-the-job training is o often lacking. Trained personnel require in- ntives to stay on the job after training. Failure to fill training requirements may be considered a eech of contract where certain training must adually be shifted from outside training advisors local trainers. Four projects involving a large ining component are described. These are: train- g in rural water supply in Malawi, training the ofessionals and technicians in Tanzania, a train- g project for operation and maintenance in enya, and training of trainers in the East Caribbe- The PANO/GIBA report has defined the jor activities of the training program. These lude: development of the training delivery tem organization, training of trainers, develop- nt of training/job manuals, and manager/super- or workshop and premier briefing. (Geiger- T)
6-02342

D. Grants, Contracts, and Research Act Allotments

STORY OF THE STATE WATER RE- URCES RESEARCH INSTITUTE PRO- AM,
ological Survey, Reston, VA. Water Resources

. Burton.
ailable from OFSS, USGS, Box 25425, Lake- od, CO 80225. USGS Open-File Report 84-736, 4. 49 p, 6 fig, 7 tab, 64 ref.

criptors: Administration, Education, Adminis- ive agencies, *Water Resources Institutes, Uni- sities, *Technology transfer, History, Manpow- Research priorities, *State Water Resources earch Institute Program, *Water Resources ntific Information Center.

State Water Resources Research Institute Pro- n, established in 1964, consists of 54 Water ources Research Institutes located at land-grant versities in each of the 50 states and Puerto o, the District of Columbia, Guam, and the gin Islands. The program evolved from the er Resources Research Act of 1964, as amend- the Water Research and Development Act of , Public Law 94-457, and the Water Research Development Act of 1984. These laws author- he following components of the Institute Pro- n: (1) the annual allotment and matching grants gram for the institutes and (2) the additional saline water research programs for organiza- in addition to the State Water Resources earch Institutes. This report summarizes the lative history, budget history, research pro- n development, and program accomplishments. State Water Resources Research Program has administered to by the Office of Water Re- ces Research (OWRR) (1964-1974), the Office Water Research and Technology (OWRT) 4-1982), the Office of Water Policy (OWP) 2-1983), and the U.S. Geological Survey GS) (1983-present). (USGS)
-02347

TER-RESOURCES ACTIVITIES OF THE GEOLOGICAL SURVEY IN MISSOURI, AL YEAR 1985,
ogical Survey, Rolla, MO. Water Resources

primary bibliographic entry see Field 7C.
-02375

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN TEXAS-- FISCAL YEARS 1982-84,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02396

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

PARAHO ENVIRONMENTAL DATA: BIBLI- OGRAPHY,
Development Engineering, Inc., Rifle, CO.
L. K. Talley.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-019378, Price codes: A02 in paper copy, A01 in microfiche. May 1981. 19 p. EP-78-C-02-4708.A000.

Descriptors: *Bibliographies, *Water pollution effects, *Oil shale, *Coal liquefaction, Toxicity, Land reclamation, Revegetation, Vegetation establishment, Public health, Safety, Leachates.

A bibliography on oil shale processing includes references on process characterization, air quality, water quality, land reclamation and revegetation, biological effects, occupational health and safety, and end use. (Cassar-PTT)
W86-01983

FLUCTUATING WATER LEVELS IN RESER- VOIRS; AN ANNOTATED BIBLIOGRAPHY ON ENVIRONMENTAL EFFECTS AND MAN- AGEMENT FOR FISHERIES,
Fish and Wildlife Service, Fayetteville, AR.
G. R. Ploskey.
Technical Report E-82-5, May 1982. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 142 p. Intra-Army Order WESRF-80-112.

Descriptors: *Bibliographies, *Environmental effects, *Water level fluctuations, *Reservoirs, *Aquatic life, Aquatic habitats, Habitats, Fish, Invertebrates, Aquatic plants, Macrophytes, Productivity, Zooplankton, Limnology, Water quality, Algae, Nutrients, Drawdown, Erosion, Temperature, Water temperature, Turbidity, Falling stage, Rising stage.

The effects of reservoir water level fluctuations on fish is the subject of a 367-reference annotated bibliography. Affected are physicochemical variables, alagae, aquatic invertebrates, fish, fishing, erosion, and reservoir aesthetics. Research on natural lakes, ponds, marshes, and floodplains is included when data contribute to an understanding of aquatic systems in general. A subject index lists several main headings: biology, fish taxa, and limnology (chemical and physical). Examples of subjects under the main headings are fish (with 17 subheadings), drawdown, high water, erosion, temperature, reservoirs, receding waters, and rising waters. (Cassar-PTT)
W86-02033

WATER QUALITY, MACROINVERTEBRATES, AND FISHERIES IN TAILWATERS AND RE- LATED STREAMS: AN ANNOTATED BIBLI- OGRAPHY,
Fish and Wildlife Service, Bowling Green, KY. East Central Reservoir Investigations.
C. H. Walburg, J. F. Novotny, K. E. Jacobs, W. D. Swink, and T. M. Campbell.
Technical Report E-81-8, May 1981. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 200 p. Interagency No. WES 79-04.

Descriptors: *Bibliographies, *Environmental effects, *Reservoirs, *Aquatic life, *Tailwater, Fish, Invertebrates, Aquatic habitats, Habitats, Streams, Dams, Flow, Water quality.

An annotated bibliography lists available literature information on water quality, macroinvertebrates, and fish in tailwaters and related streams. It is divided into two sections: (1) tailwater studies - references which show the project-imposed changes in water flow and quality on the tailwater environment and downstream biota and (2) stream studies - selected references on stream studies which are applicable to tailwater research. (Cassar-PTT)
W86-02035

10D. Specialized Information Center Services

HISTORY OF THE STATE WATER RE- SOURCES RESEARCH INSTITUTE PRO- GRAM,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 9D.
W86-02347

10F. Preparation Of Reviews

REVIEW OF THE CHEMISTRY AND ENVI- RONMENTAL FATE OF REACTIVE OXIDANT SPECIES IN CHLORINATED WATER,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5F.
W86-02136

REVIEW OF ANALYTICAL METHODS FOR REACTIVE OXIDANT SPECIES IN CHLORIN- ATED WATERS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W86-02177

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			30.50		760.00
			33.00		835.00
		E13	35.50		910.00
			38.50	T14	1,135.00
		E15	42.00		1,210.00
			46.00	T16	1,285.00
			50.00		1,360.00
			54.00		1,435.00
			60.00		1,510.00
		E20	70.00		
		E99			

*Contact NTIS for price quote

PRICES EFFECTIVE JANUARY 1, 1986

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